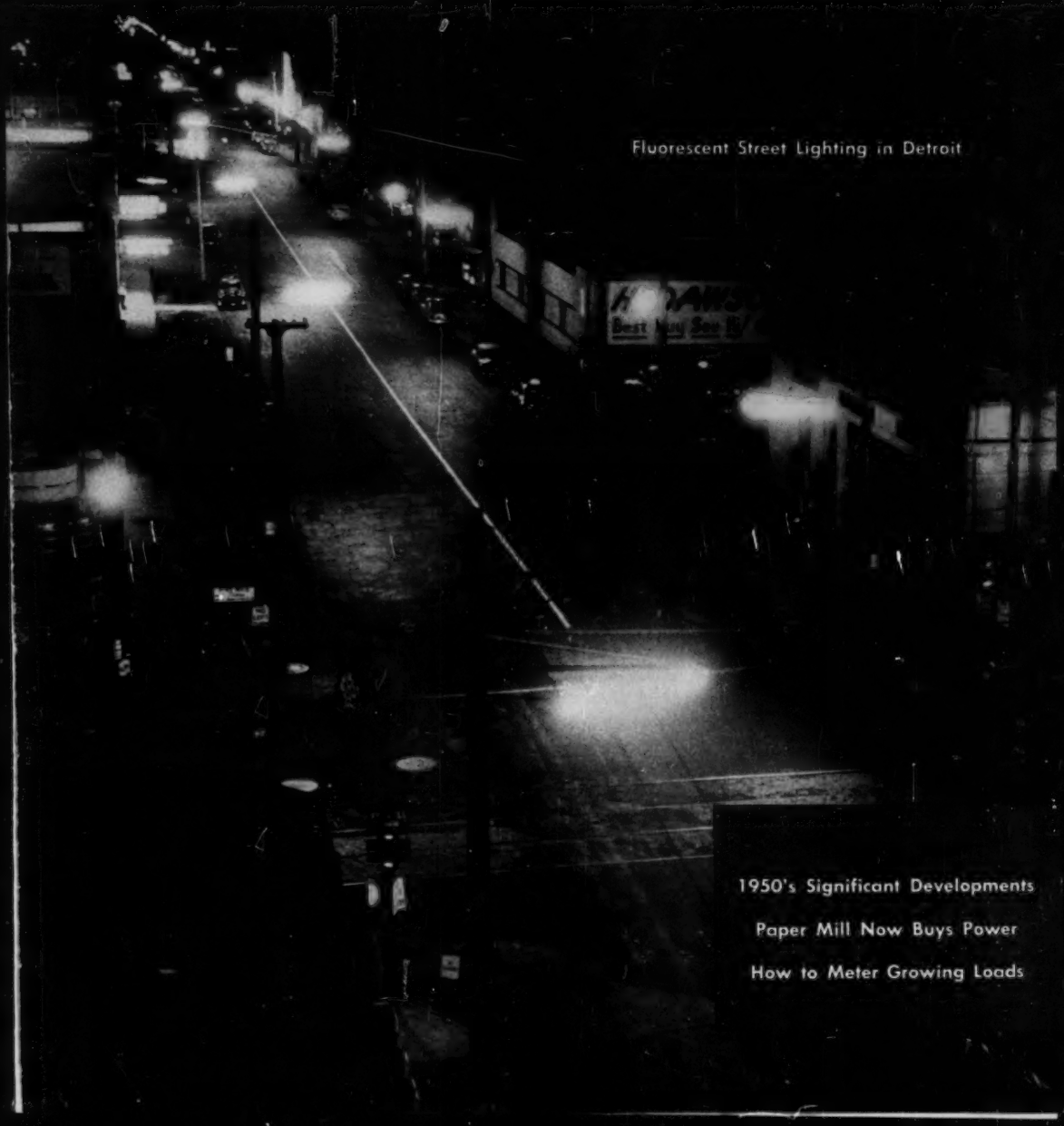
JANUARY 1, 1951

Electrical World

A McGRAW-HILL PUBLICATION

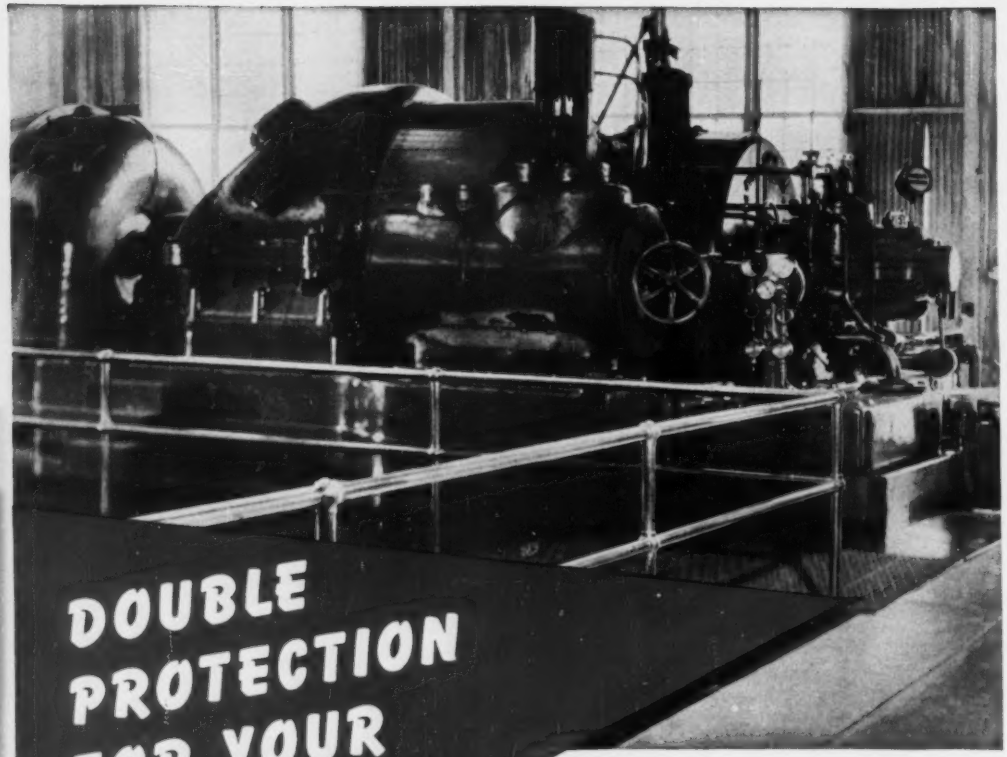


Fluorescent Street Lighting in Detroit

1950's Significant Developments

Paper Mill Now Buys Power

How to Meter Growing Loads



DOUBLE PROTECTION FOR YOUR TURBINES

. . . because TEXACO REGAL OILS (R&O) are 2 ways better

Here's what makes *Texaco Regal Oils (R & O)* two ways better: *First,* superior base stocks. Only a basically fine oil can stand up in turbine service. *Second,* special inhibitors and processing that enhance a naturally high resistance to oxidation, rusting and foaming. Additives by themselves can't make a good turbine oil.

For years before the advent of additives, *Texaco Regal Oils* were world-famous as straight mineral turbine oils of exceptional quality. Additive-fortified *Texaco Regal Oils (R & O)* are more than 10 times as resistant to oxidation, give longer lasting protection against rust and foaming.

Thus, trouble-free turbine performance follows when you use *Texaco Regal Oils (R & O).* You're assuring clean lubricating systems . . . normal bearing temperatures . . . smoothly responsive governor action . . . with an oil of exceptionally long service life. *Texaco Regal Oils (R & O)* meet the stringent requirements of all leading turbine builders.

Let a Texaco Lubrication Engineer tell you more about the cost-saving advantages of *Texaco Regal Oils (R & O).* Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write:

The Texas Company, 135 East 42nd Street, New York 17, New York.

TEXACO

TEXACO Regal Oils (R&O)

FOR ALL TURBINES

TUNE IN . . . TEXACO presents MILTON BERLE on television every Tuesday night. METROPOLITAN OPERA radio broadcasts every Saturday afternoon.

In the Next Issue

In the last year or so industry has been making important use of ozone, and since it's now made with electricity at a high load factor, utilities have watched the development with interest.

One of its most useful jobs is purifying water. Ozone can now be made quickly and economically in large quantities, and it not only purifies water but takes out the taste and the odor. It's a blessing in Philadelphia, where city water comes from the Schuylkill River. To those not accustomed to it, Schuylkill water tasted like something difficult to put into words.

Ozone is also used to oxidize waste and is replacing many hard-to-get chemicals. Victor Hann, director of the Welsbach Corp's Ozone Processes Division tells all about it in Electrical World for January 1.

Customer Relations

Nobody likes to have people prowling about one's yard, unless they know why. This simple fact poses a problem for the utility man who tests meters. Duquesne Light gets around it in three simple steps.

1. Trucks carrying testing apparatus also carry prominent signs explaining what they are and what they're doing.

2. Meter men carry a small, four-page brochure explaining the job and bearing each man's name. These are presented to the customer.

3. Each man wears a big, chromium shield, prominent as a sheriff's badge in a western movie.

Customers now are completely reassured.

Steam Station Lights

Washington's PEPCO did such a good job of lighting in their new Potomac River Steam Station that several other stations have patterned their lighting installations on it.

It seems that steam stations have some special lighting requirements.

Some of the innovations that make the job outstanding are told in an article by Dave Tuck of Holophane who planned and engineered the job, and F. A. O'Brien of Stone & Webster, whose firm designed and built the station.

This is January 1. May we send sincere wishes to you for a year of accomplishment and happiness, from

THE EDITORS

Electrical World

Published for 76 years for those engaged in the business of generating, transmitting, distributing or applying electric power

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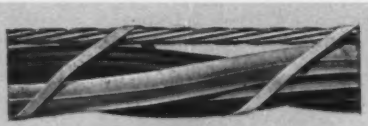
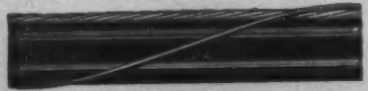
with stormsafe *OKOLITE-OKOPRENE* aerial cables

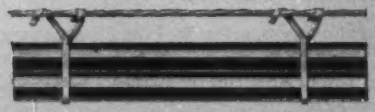


Okolite-Okoprene Self-Supporting Aerial Cable with in-built messenger. Made with Dualay® design for easy lapping.



Okolite-Okoprene cables can be lashed to messenger by spinner method.

● In the Dualay method (U.S. Pat. 2,430,378) the insulated conductors are twisted together so that the direction of lay is reversed at regular short intervals to permit conductor separation without cutting the copper or performing any operation on the messenger.



Okolite-Okoprene cables may be installed in regular messenger rings.

► Ice storms, hurricane winds, flooding rains, power lines down — *but not out.* Every season of the year brings further evidence on the greater freedom from outages and service interruptions when long-lived, dependable Okolite-Okoprene aerial cables are used. Their time-proven components — a tough weather resistant Okoprene sheath, permanently bonded to dense, moisture resistant, high voltage Okolite insulation — and strong mechanical designs give superior protection against wind, icing and moisture.

But storm resistance is only one of the many advantages of Okonite aerial cables. Whether self-supporting, ring-supported or spinner-lashed, they provide the sound values of reasonable first cost, low installation and maintenance costs. Their lower reactance gives improved circuit regulation and lower voltage drop. Neat and compact, they save space, eliminate cross-arms and congestion on poles, greatly reduce or even make tree trimming unnecessary. And they afford greater protection to linemen, public safety and property.

Generally recognized for their advantages on primary circuits, Okonite cables of this economical design are being used more and more for street lighting circuits, for secondaries — including networks — and for service drops. In addition to their suitability for utility overhead systems, Okonite aerial cables are extensively used by industrial plants and railroads for power, lighting, communication and control systems. Details on the many types available, with complete data on selection and installation, are combined in Bulletin EW-1033. Just write The Okonite Company, Passaic, N. J.

THE BEST CABLE IS YOUR BEST POLICY

OKONITE OKONITE SINCE 1878 *insulated wires and cables*

7942

ANCHORAGE for the NEUTRAL SUPPORTED SYSTEM OF SERVICE DROPS . . .

PAT. PEND.

Electroline Automatic Dead End

The 3800 Series Service-Drop Automatic Dead End, for holding pre-assembled service cable that uses a bare neutral conductor as the messenger. This service-drop dead end is assembled as a one-piece unit, with no loose parts to be dropped or lost. It has one end of the flexible bail detachable for installation around a spool type insulator or other supporting anchorage—permitting quick and easy installation. Only one part, other than the conductor, is handled by the lineman. This Electroline Automatic Service-Drop Dead End can be reclaimed and used again. But, once it is installed, it cannot become detached until conductor is removed by the lineman. The practice of gripping the bare neutral employed by the Electroline method of dead ending eliminates the danger of destroying the insulation and short circuiting phase wires.

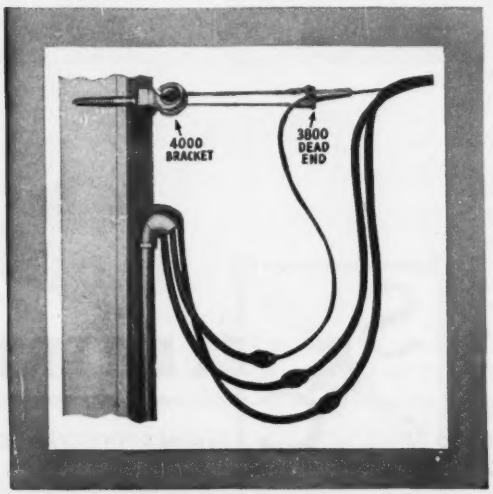
Electroline Anchor Bracket

The 4000 Series Service-Drop Anchor Bracket securely supports the cable at any angle. It is so designed that a closed bail or loop can be easily inserted without opening the loop. This one-piece, light weight unit reduces installation costs and no previous experience is necessary to install it.

The 4000 Bracket eliminates the insulator and insulator hardware at the building.

Two types are available: one with a ½" diameter galvanized lag screw in lengths from 3" to 5" inclusive. The other type contains a ½-13 galvanized nut for use in installations where a threaded end of bolt extends through wall of building.

The Electroline 4000 Series Anchor Bracket is made of aluminum and a galvanized steel lag screw, or nut to withstand corrosion and the discoloration of outside building walls . . . it is vibration-proof and fool-proof.



Both the Electroline Service-Drop Automatic Dead End and Anchor Bracket are designed to harmonize with residential and commercial buildings.

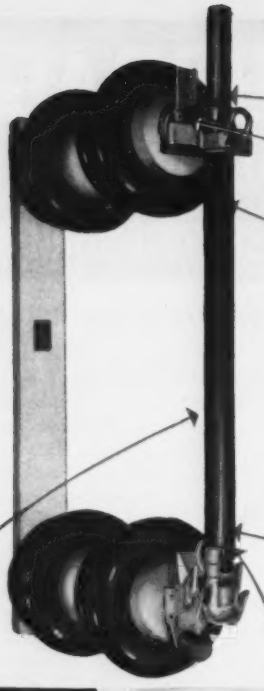
Write for new bulletins for complete details.

Electroline Company

4121 South La Salle Street **Chicago 9, Illinois**

IN CANADA
POWERLITE DEVICES, LTD., TORONTO

6 Good SMD-2 POWER



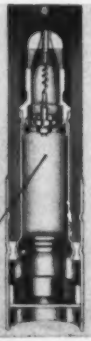
High Interrupting Capacity
(Up to 1,000,000 KVA)

Compressed Boric Acid
Moving Arcing Rod
Vulcanized Fibre Liner (for added impact strength)
Laminated Bakelite Tube

High Recovery Voltage Withstand Ability

—because stress cones distribute transient high frequency voltage stress that occurs immediately after arc interruption and before drop-out.

Lower Stress Cone



2.

Permanent Accuracy of Time Current Characteristics

. . . because fusible element is non-damageable.

For example:

Low Current Fusible Element of nickel-chrome, pretensioned.

Series of Levers —approx. 150-1 ratio — reduces drive spring pull to correct degree for pretensioning of hair-like fusible element.

3.

✳**FULL COVERAGE PROTECTION IS:** the new concept of transformer fusing in which:

A primary fuse is applied for both primary short circuit and secondary back-up short circuit protection. A fuse is expected to perform dependably regardless of type of system; type of fault current; type of application; or systems and atmospheric conditions.

✳**FULL COVERAGE PROTECTION PROVIDES**—along with the above protection—savings in operating expense by:

Eliminating the need for replacement of "suspect" fuses on other phases when one fuse blows.
Eliminating the need for periodic replacement of fuses to prevent "sneak-outs" caused by vibration- or age-weakened fusible elements.

✳**FULL COVERAGE PROTECTION REQUIRES:** dependable high and low fault-current interrupting ability;
protection against dielectric breakdown or external flashover from severe recovery voltage;
a fine degree of accuracy in time-current characteristics;
a "non-damageable" fusible element which cannot be injured by surge currents, vibration, or aging;
a choice of time-current characteristics to provide flexibility in coordinating with other primary, and with the secondary, protective devices.

S&C ELECTRIC

Formerly SCHWEITZER & CONRAD,

Reasons Why FUSES GIVE YOU Full Coverage* Protection

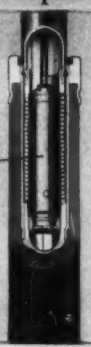
Featured here are some of the design reasons why the SMD-2 Power Fuse can be used, within its interrupting capacity, for *any* fusing application, at *any* point on your system. It is especially recommended for economical and reliable protection of stations tapped directly on high lines.

Fusible elements for the SMD-2 are made in a range of speeds, so reclosing breakers can be coordinated with the fuses to clear transient faults. Time-current characteristics are accurate and enduring, guaranteeing that coordination will be permanent.

If your protection problem involves severe recovery voltage, critical coordination, extremely low or extremely high fault current, the SMD-2 Drop-Out Power Fuse is the solution.

Positive Low Fault Interruption

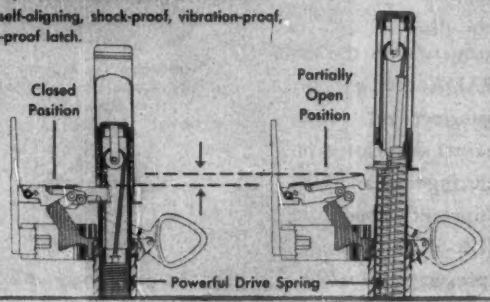
CO_2 Gas Bomb — to insure rapid arc extinction in low current faults.



4.

Dependable Mechanical Action

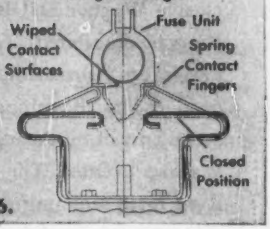
—by self-aligning, shock-proof, vibration-proof, glaze-proof latch.



5.

Self-cleaning, "Non-freezing" Contacts

...because of wiping-in, rolling-out design.



6.

For a complete explanation of these and other distinctive features, ask for our new Catalog Section 262

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S&C Electric Company, Chicago

Mail immediately a copy of your new Catalog Section 262

Name .....

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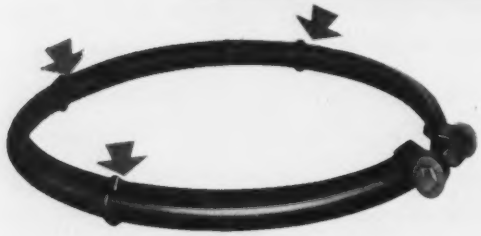
State .....

COMPANY 4421 Ravenswood Avenue Chicago 40, Illinois, U. S. A.

INC. In Canada, Powerlite Devices, Limited, Toronto

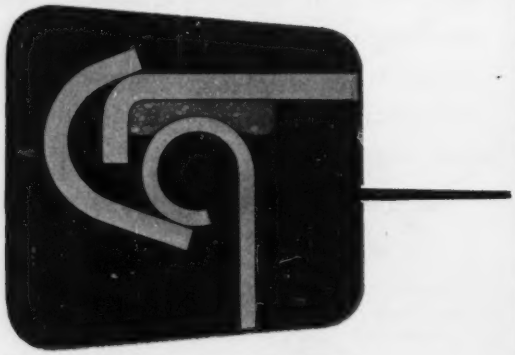
NEW Wagner Wagner

ASSURE SEALED-TANK CONSTRUCTION
LONGER TRANSFORMER LIFE
LOWER MAINTENANCE COSTS

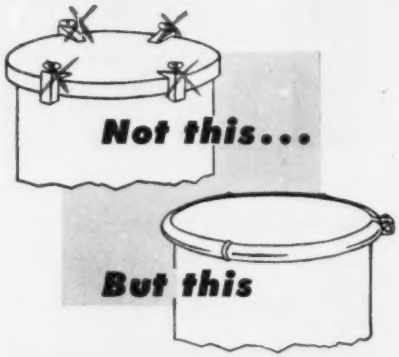


The SHUR-SEAL Clamping Ring has three grooved channels which prevent water from accumulating on the cover.

Wagner Form W Transformers with the exclusive Wagner SHUR-SEAL Cover . . . *plus* Wagner Inhibited Transformer oil assure maximum protection against deterioration produced by "breathing" during the daily load cycle. Loss of oil during shipment or handling is also prevented. The SHUR-SEAL Clamping Ring maintains uniform pressure *around the entire periphery* of the cover—and yet permits easy removal of the cover by loosening a *single* stainless steel bolt. Wagner Form W Transformers offer sealed tank construction, air-tight as a welded tank, but with covers that can be removed if necessary.



Here's how the Wagner SHUR-SEAL Clamping Ring securely locks the cover to the tank. Corprene gasket is compressed to assure an air-tight seal.



The Wagner SHUR-SEAL Clamping Ring maintains equal pressure all around the cover.

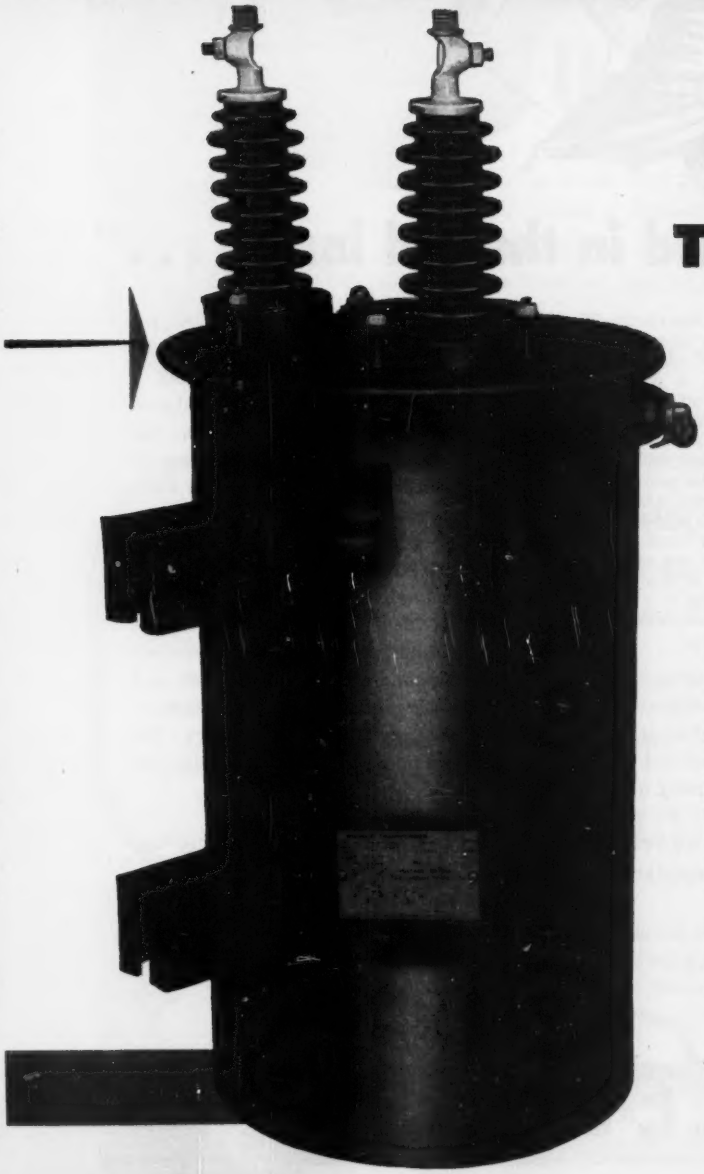
Wagner Electric Corporation
EST. 1891

ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES
AUTOMOTIVE BRAKE SYSTEMS – AIR AND HYDRAULIC

T51-1

BRANCHES IN 31 PRINCIPAL CITIES

SHUR-SEAL Cover Inhibited Oil



Wagner

Form W

Transformers

Wagner Form W Transformers, with preformed cores of cold rolled oriented grain steel, are small in size, light in weight, yet are liberally designed. They are easy to handle, to store, and to mount on poles.

They give you excellent electrical performance . . . core and copper losses are low—regulation at both 100% and 80% PF is good—and exciting current is extremely low. High short time overload capacity provides good peak load performance. Form W Transformers are built to pay dividends in extra service—because they're built the Wagner way—with sixty years of transformer building experience behind them. Why not investigate them today?

Wagner Electric Corporation
6456 Plymouth Ave., St. Louis 14, Mo., U. S. A.

"It happened in the 3rd inning . . ."

It was the first day of the World Series. A big razor manufacturer had paid some $800,000 for the rights to televise the games. It was the third inning—and the Yankees and Phillies were tied 0 to 0. Millions of fans were glued to their sets when—pfft!—three million sets went black, and for twenty minutes there was no game insofar as television was concerned! What happened?...I don't know—that's for the sponsor and the broadcasting company to decide. But you can bet your bottom dollar that it was some little thing—like insulation at a vital point—that caused the breakdown!

In electrical insulation, the price of failure is severe—product breakdown, rejects, lost time and labor.

That's why you find BH "649" Fiberglas Tubing and Sleeving in equipment that must not fail—jet planes, electronic equipment, engines. Manufacturers of home appliances and industrial equipment, who insist on BH "649", get this same high measure of protection for their tough insulation problems.

In BH "649" they get an insulation that is toughened against abrasion, will not support combustion. Stays supple after baking 12 hours at 300°F. Does not crystallize at −67°F. Unaffected by grease and oil. Speeds production because it cuts without fraying, spreads to cover knobs and terminals.

BH "649" is one of a family of BH-insulations, each designed to meet particular conditions in service. Give us a few facts about your requirements—product, temperatures, voltages. We will furnish production samples for testing.

Address Dept. W-1
Bentley, Harris Manufacturing Co.
Conshohocken, Pa.

BH *Fiberglas** **SLEEVINGS**

*BH Non-Fraying Fiberglas Sleevings are made by an exclusive Bentley, Harris process (U. S. Pat. No. 2393530). "Fiberglas" is Reg. TM of Owens-Corning Fiberglas Corp.

Test after Test

has proved the PENN-TAP'S

Unequalled Strength

No other fitting of this type has matched the Penn-Tap in tensile strength, in numerous tests to destruction. The reason is obvious:

The Penn-Tap is more sturdily constructed . . . exceptionally tough silicon bronze alloy and *more of it* (at no added cost).

For taps, service entrance connections, dead ends . . . indoor or out. Quickly installed with ordinary wrench.

ONE PIECE—no loose parts . . . swivels on one locked bolt. Holds tight permanently. 7 sizes, for cables 10 Str. to 1,000 MCM.

Only one other Split Bolt Connector can take as high clamping pressures as PENN-UNION

Hundreds of competitive torque tests, of Penn-Union Split Bolt Connectors against other fittings of this type, have shown:

The Penn-Union Connector is *definitely stronger than all others except one, which closely follows Penn-Union design and is nearly equal.*

Excepting this one similar fitting, the Penn-Union Connector withstands clamping pressures 15% to 55% higher.

MAKE THESE TESTS YOURSELF. We will gladly furnish sample Penn-Union Connectors for tests against any other make. *Just tell us the sizes you are using.*

Sold by Leading Wholesalers

PENN-UNION ELECTRIC CORPORATION • ERIE, PA.

Canada: Dominion Cutout Company, Ltd., 250 Richmond Street, West, Toronto

The *Complete* LINE of CONDUCTOR FITTINGS

PENN-UNION

Needed 1000 producers

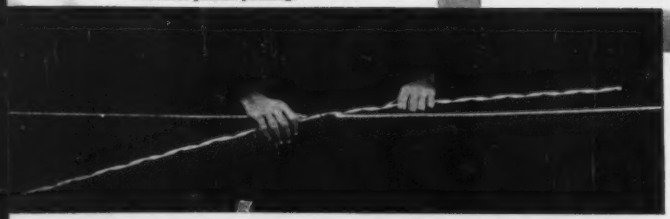
Ordinarily, the needs of this Country (and many others) for conductor and strand are amply satisfied by the many fine American manufacturers of wire and cable. But now . . . and for some time into the future . . . when loads are mounting and demands for and on transmission systems are reaching unprecedented levels . . . when shortages of men and materials are developing . . .

You must be a producer of conductor . . .

HOW?

1. By rehabilitating and reinstalling old conductors.
2. By increasing the current-carrying capacity of existing lines.
3. By lengthening the life expectancy of present and future lines.

Preformed Armor Rods are for use under Patent No. 2,275,019 . . . other patents pending.



Preformed Armor Rods are furnished in half sets for splicing and/or repairing.

YOUR EQUIPMENT

All you need are Preformed Armor Rods and a *Pair* of hands for:

1 — Splicing, armoring at supports and dead-ends.

2 — Repairing conductors and strand in place or in your salvage yard for reinstallation.

3 — Jumpers for old splices.

# of conductor and strand...

Preformed Armor Rods will . . .

- **INCREASE the current capacity of splices, conductors in clamps, dead-ends and so on, by more than 30%.**
- **LENGTHEN the life of conductors where vibration, arcing and burning take their toll.**

Easily installed in three minutes . . . even by inexperienced linemen . . . Preformed Armor Rods protect conductors better and at lower cost than ordinary armor.

They are better because only PLP rods grip uniformly over the entire conductor length.

They are less expensive because your linemen make perfect installations every time, far quicker than with ordinary armor. Less expensive because only PLP rods eliminate concentrated stresses common in other forms of conductor protection.

Complete technical details and installation records are available. Just write to: *PREFORMED LINE PRODUCTS COMPANY, 5349 St. Clair Avenue, Cleveland 3, Ohio.*

PLP ARMOR RODS ARE AVAILABLE IN ALUMINUM, COPPER, BRONZE, COPPERWELD, STAINLESS STEEL AND GALVANIZED STEEL—A TYPE FOR EVERY CONDUCTOR.

Take half to all of the rods needed and lay them across and around the conductor.

Wrap around conductor several times . . . like wringing water from a cloth. Apply remainder of rods.

Continue wiping action along conductor.

The finished job.

PREFORMED

PLP

LINE PRODUCTS CO.

CLEVELAND 3, OHIO

NEW CONDUCTORS?

Naturally, you will want to spend only 2 to 3% of new conductor cost to eliminate vibration damage, clamp and tie damage, burning and slipping.

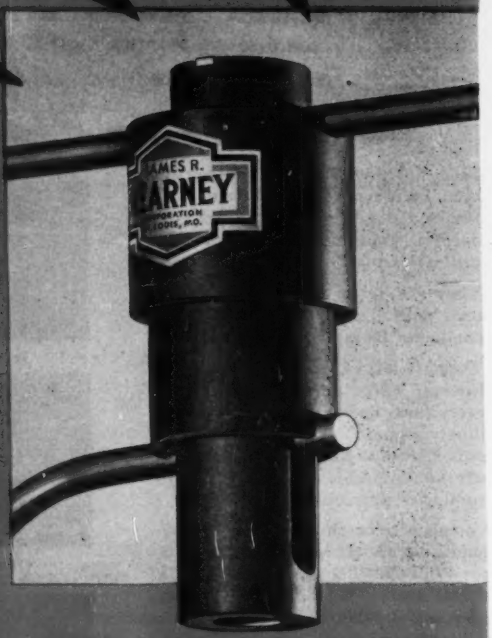
ISOLATE SERVICE ENTRANCE FAULTS

PROTECT TRANSFORMERS FROM SECONDARY FAULTS

MAKE BANKING OF SECONDARIES POSSIBLE

with the

KEARNEY Secondary Fuse Cutout



Here is the most efficient inexpensive way possible to protect expensive transformers and other equipment from secondary faults.

Sturdily constructed of non-metallic material this cutout transfers current from the secondary to the tap directly through the link itself with no intermediate connection or transfers.

Designed without nuts or bolts to tighten — refusing and installing is a matter of seconds.

Write for more detailed information.

JAMES R. KEARNEY CORPORATION

4224-42 Clayton Ave., St. Louis 10, Missouri

Canadian Plant: Guelph, Ontario

STEP ONE | STEP TWO | STEP THREE

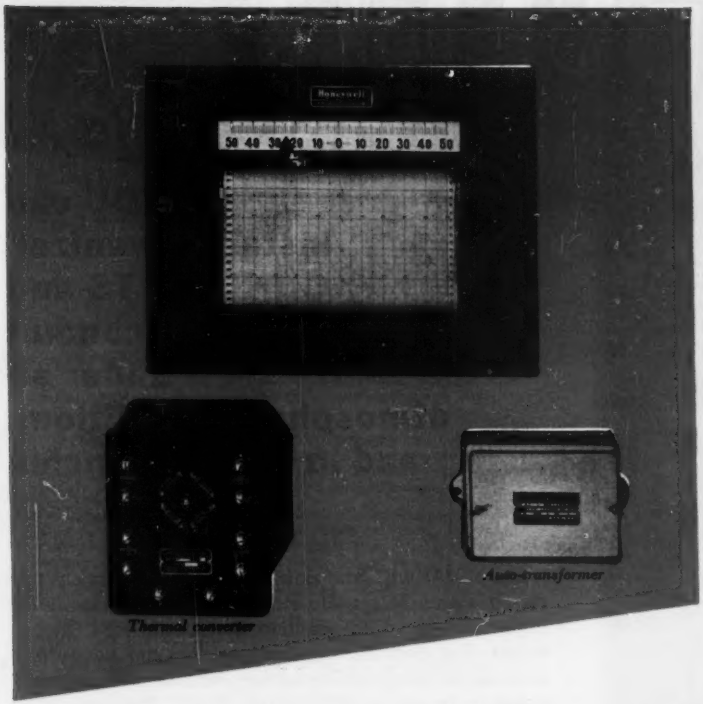
STEP ONE: Drop the fuse link in the top opening of the cutout. Then, compress the lower shell and insert the tap wire in the hole provided in the link.

STEP TWO: Compress top shell and twist to the right or left so that it stays in the open position.

STEP THREE: Hang the cutout on the secondary, release top shell by twisting to make the final pressure contact with the secondary.

BETTER CONSTRUCTION *Safer* MAINTENANCE

Keep A Weather Eye On All Three



1 Individual Generator Output

2 Total Station Output

3 System Loads and Trends

...With This *ElectroniK* Recorder and special components

CONTINUOUS indication and recording of power generated is of prime importance to the operation of every central station.

The *ElectroniK* Strip-Chart Recorder, using a thermal converter, accurately provides such vital information when used as a wattmeter. And . . . with the help of a phase shifting autotransformer and a thermal converter . . . it can be used as a varmeter, for accurate recording of the non-useful energy generated.

Total result: a preventive check on generator overloads; immediate information for load dispatching; easily filed tabulation of interchanged power.

This is another indication of how the Brown approach to instrumentation offers positive steps toward the maintenance of maximum operating efficiencies. For more detailed information, call in your local Honeywell engineer . . . he is as near as your phone.

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, 4568 Wayne Ave., Phila. 44, Pa. Offices in more than 80 principal cities of the United States, Canada and throughout the world.

MINNEAPOLIS Honeywell

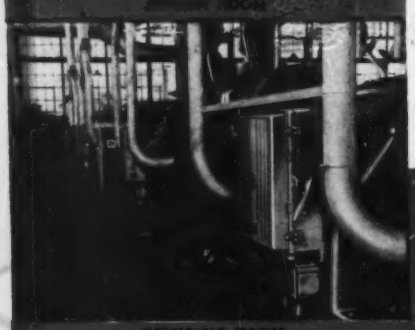
BROWN INSTRUMENTS

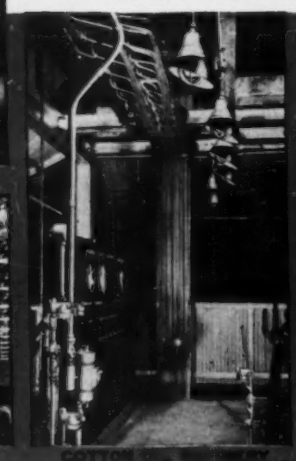
CONDULETS* and rigid conduit

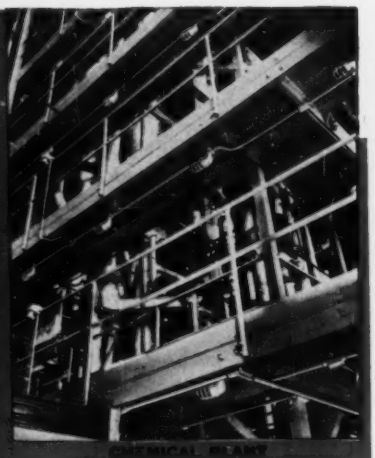
YOU can install galvanized CONDULETS and galvanized rigid conduit under all atmospheric conditions and in all occupancies

(See Article 346, Section 3462, National Electrical Code.)

The **CONDULET** and rigid conduit method meets the requirements of the National Electrical Code in locations exposed to weather, heat, moisture, steam, vapor, dust and dirt or locations that are hazardous because of the possibility of the presence of flammable gases or vapors, or combustible dusts. The same sterling qualities that make **CONDULETS** the first choice in these special applications, make them first choice in **ALL** ordinary locations.







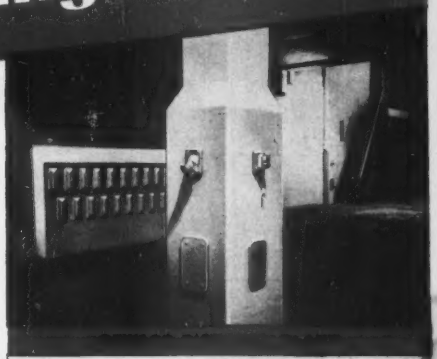
**CONDULET is a coined word registered in the U. S. Patent Office. It designates a product made only by the Crouse-Hinds Company.*

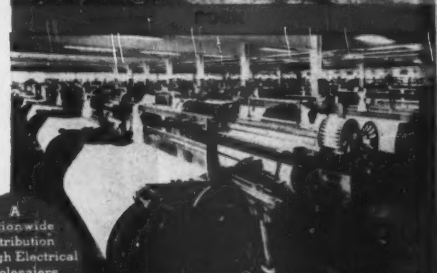
....the UNIVERSAL wiring method

"for MODERN WIRING . . .

the CONDULET and conduit method

gives you definite advantages"





1 MECHANICAL PROTECTION . . . Rigid conduit and cast Feraloy CONDULETS provide the best possible protection against accidental damage to the wiring and equipment. Prevents costly shutdowns.

2 SAFETY . . . A CONDULET installation gives maximum protection against personal injury and fire. The continuous conduit system made up with taper threaded CONDULETS provides a reliable and permanent low resistance path to ground.

3 FLEXIBILITY . . . To meet all the diverse requirements of modern electrical layouts, CONDULETS are made in a wide variety of shapes and sizes with varied hub arrangements, including a full line of CONDULETS with detachable hub plates.

4 ECONOMY . . . The installed cost compares favorably with other methods, while the total cost over the years is definitely lower, due to the durability, reliability, safety, and low maintenance cost of a CONDULET and rigid conduit system.

5 CORROSION RESISTING . . . Galvanized cast Feraloy CONDULETS offer the best protection wherever moisture, dust or corrosive atmospheres are present.

6 QUALITY . . . The trademark CONDULET stands for reliability and long life. Every CONDULET is built to Crouse-Hinds high standard of quality with painstaking care by skilled craftsmen.

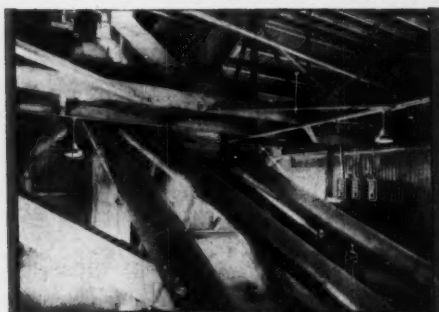
On **YOUR** next electrical layout, for any location, plan to get all the benefits of sturdy cast Feraloy CONDULETS and rigid conduit . . . the UNIVERSAL wiring method. More than 15000 types and sizes are listed in the CONDULET Catalog.

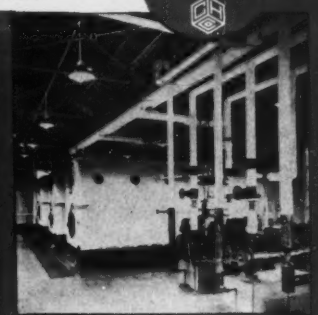
CROUSE-HINDS COMPANY

Syracuse 1, N. Y.

Offices: Birmingham — Boston — Buffalo — Chicago — Cincinnati — Cleveland — Dallas — Denver — Detroit Houston — Indianapolis — Kansas City — Los Angeles — Milwaukee — Minneapolis — New York Philadelphia — Pittsburgh — Portland, Ore. — San Francisco — Seattle — St. Louis — Washington. *Resident Representatives:* Albany — Atlanta — Baltimore — Charlotte — New Orleans — Richmond, Va. CROUSE-HINDS COMPANY OF CANADA, LTD., TORONTO, ONT.

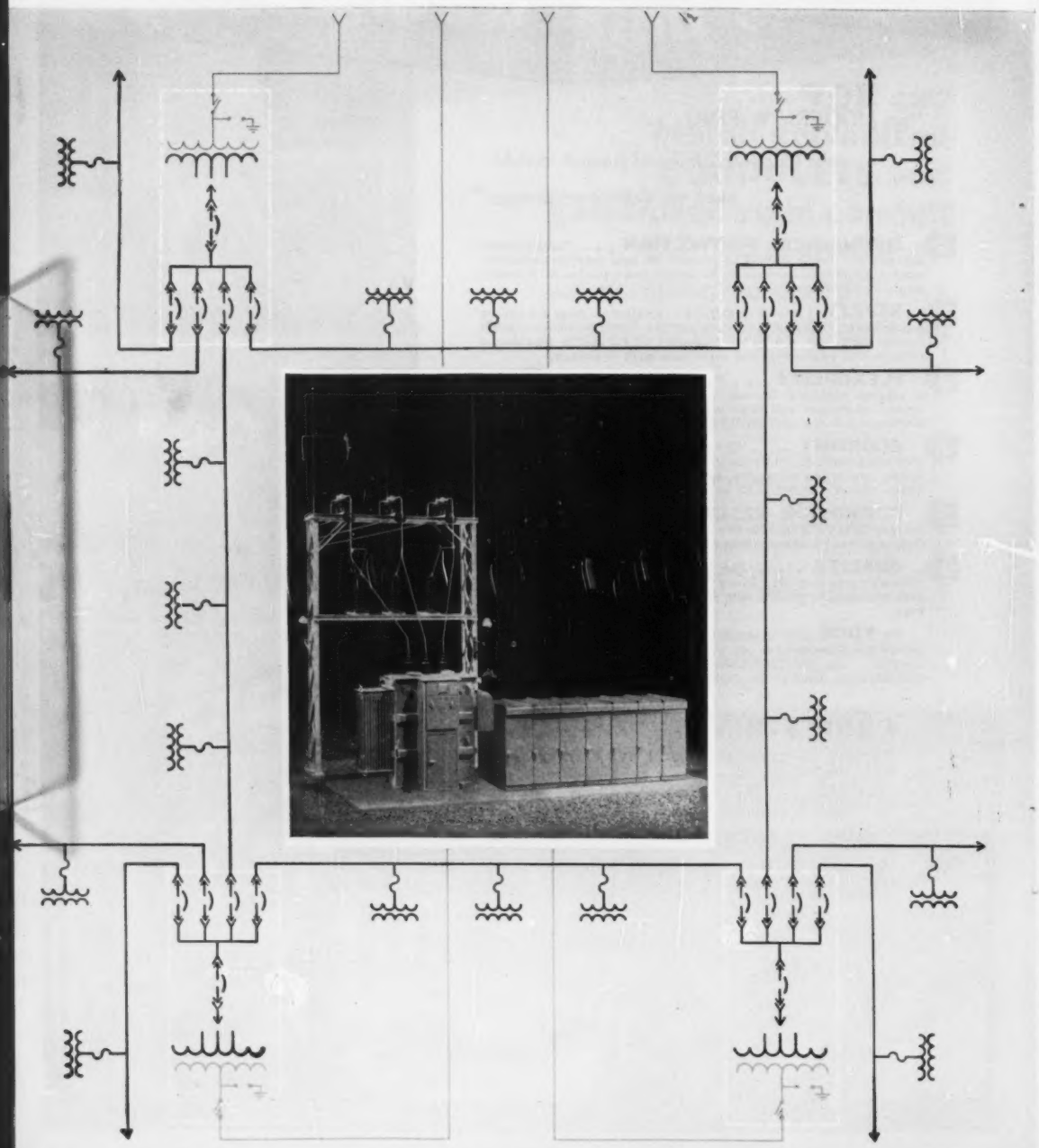
A Nationwide Distribution Through Electrical Wholesalers





YOU CAN BE **SURE**.. IF IT'S

Westinghouse



Co-ordinated Substation of the Primary Network type energized from a single subtransmission circuit.

CO-ORDINATED SUBSTATIONS

Help Simplify Systems *and* Lower Power Distribution Costs

The substations you choose *now* will become vital tools in building simplified systems . . . *and* lowering power distribution costs; therefore, *their inherent design must provide for these factors.*

The Westinghouse Co-ordinated Substation, shown here, is one example. It is a compact standardized unit designed to economically answer Primary Network requirements. It is completely co-ordinated from incoming line facilities to outgoing feeders.

This relatively small, bus-regulated substation, and its associated system, economically simplify many distribution problems. Individual feeder regulation is eliminated. Fewer high-voltage breakers are required. The cost of switching on the subtransmission side of the station is reduced. Unitized construction provides flexibility for meeting future load requirements. Transformers and breakers can be quickly de-energized for maintenance . . . without service interruption.

As you plan for the future and gradually simplify your system, be sure you have considered the benefits of Westinghouse Co-ordinated Substations. Their part in long-range power distribution economies has been carefully considered in every phase of their design and construction. More information is given in Booklet B-4061. Ask your Westinghouse representative or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-60729-A

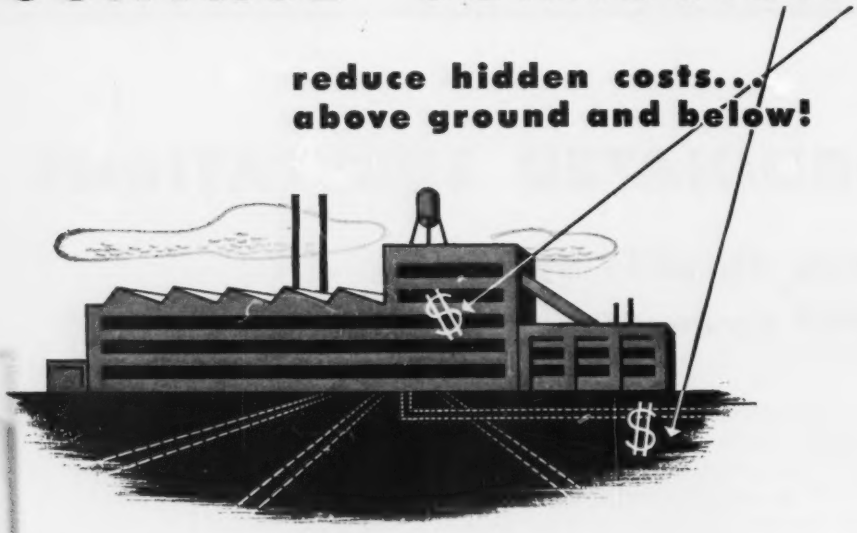
Westinghouse

COORDINATED SUBSTATIONS

WESTINGHOUSE

CONTROL CORROSION!...

reduce hidden costs... above ground and below!



Today's corrosion rate is alarmingly high! Unless you have adequate control, your business is incurring unnecessary losses. Either *directly*—due to high maintenance costs and replacement of corroded equipment; or *indirectly*—through losses due to idle equipment, loss of product and plant efficiency.

EBASCO corrosion control consulting services are applicable to:

1. All buried or submerged metallic structures—oil, water, gas pipelines and cables—both cross country and urban.
2. Manufacturing, processing and power plants—either on existing facilities or proposed new structures.

These services include a preliminary survey to determine causes of corrosion; recommendations for corrective measures; design and installation of corrosion control methods; and development of a permanent corrosion control program.

EBASCO can help you develop *your own* corrosion control program.

EBASCO specialists not only can help you spot and remedy specific corrosion troubles—but can train your own personnel in setting up *your own corrosion control program*—so you can continue to keep down these "hidden" costs.

Remember...corrosion control is something you can't afford to put off. Call in EBASCO specialists—find out what they can do to help you protect your structures now, and for years to come.

Write for the booklet *"The Inside Story of Outside Help"* describing the many EBASCO services available to you. Ebasco Services Incorporated, Dept. M, Two Rector Street, New York 6, N. Y.

ENGINEERS · CONSTRUCTORS · BUSINESS CONSULTANTS

EBASCO

Appraisal	Insurance & Pensions
Budget	Office Modernization
Business Studies	Purchasing
Consulting Engineering	Rates & Pricing
Design & Construction	Research
Financial	Sales & Marketing
Industrial Relations	Systems & Methods
Inspection & Expediting	Taxes
	Traffic

EBASCO SERVICES

INCORPORATED

NEW YORK · CHICAGO · WASHINGTON, D.C.

Ebasco Teamwork gets things done anywhere in the world

VOLTAGE
15,000 Volts (110 KV. B. I. L.)
For 2.3 to 13.8 KV. Service

CURRENT
60, 100, 160, 200, and 250 Amperes

MINIMUM TRIPPING CURRENT
Adjustable from 175% to 250% of Current Rating

INTERRUPTING CAPACITIES
Up to 20 Times Current Rating

CHECK the FACTS

STOP unnecessary fuse blowing

R&IE

Type MB

Automatic CIRCUIT RECLOSER

60 to 250 Amperes

1. a. PREVENTS UNNECESSARY BLOWING OF FUSES
   The first or instantaneous trip opens the circuit before fuses can blow or be damaged.
   b. PREVENTS DAMAGE TO WIRES AND EQUIPMENT
   Destructive arcs are extinguished before insulated wire can be burned down or seriously weakened. Tests show No 4 covered copper wire will be burned down in 4 cycles at 1500 amperes.
2. COORDINATES WITH SECONDARY FUSES
   Several different size fuses can be protected with one Recloser.
3. INVERSE TIME-CURRENT CHARACTERISTICS
   Consistent mechanical timing — free from temperature error.
4. COORDINATES WITH PRIMARY FUSES
   Permits normal fusing for selective clearing of overloads and short circuits.
5. SELECTS WITH SUBSTATION OVERCURRENT RELAYS

Time Current Curves shown in Bulletin 1371A. Write for a copy.

I-T-E R&IE

RAILWAY and INDUSTRIAL ENGINEERING CO., GREENSBURG, PA.
AFFILIATED WITH THE I-T-E CIRCUIT BREAKER CO., PHILADELPHIA, PA.
IN CANADA — EASTERN POWER DEVICES LIMITED, TORONTO

The Check List

CONDUCTOR SUPPORTS, CLAMPS AND FITTINGS

DISCONNECTING SWITCHES INDOOR AND OUTDOOR

HORN GAP SWITCHES

INTERRUPTER SWITCHES

CUTOUTS AND THERMO-RUPTERS

DISTRIBUTION EQUIPMENT

SWITCH OPERATING MECHANISMS

SUBSTATIONS

OPEN OR ENCLOSED, ISOLATED PHASE HEAVY DUTY BUSES

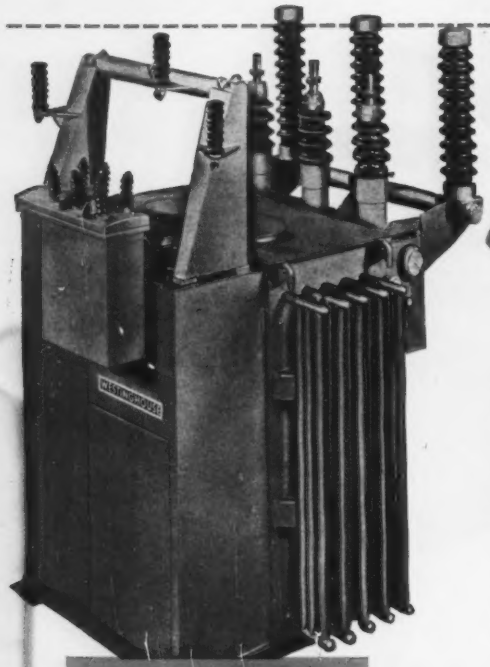
KIRK INTERLOCK SYSTEMS

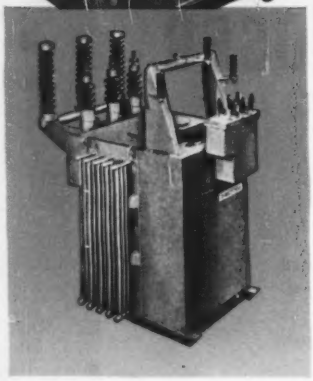
AUTOMATIC RECLOSING EQUIPMENT

METAL CUBICLES

TESTING DEVICES

YOU CAN BE **SURE**.. IF IT'S
Westinghouse





The JUNIOR "CSP" POWER TRANSFORMER

NEW ECONOMY

... for small capacity substations

Here's the substation that fills a long apparent need in the power distribution field . . . a smaller, yet complete, substation with integral high and low-voltage switchgear as well as metering equipment. And what's more, it's "CSP" (Completely Self-Protecting), with both thermal and lightning protection built in.

Designed for small towns and similar areas where the capacity of the feeder does not justify a larger rated "CSP" Power Transformer, the new "CSP" JUNIOR provides all the advantages of compactness, simplicity and ease of operation . . . PLUS *low cost.*

Available in 300 to 1000-kva ratings. For further information on all ratings of "CSP" Power Transformers, contact your Westinghouse representative, or write for Booklet B-4692. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania, J-70572-A

Westinghouse
TRANSFORMER
EQUIPMENT

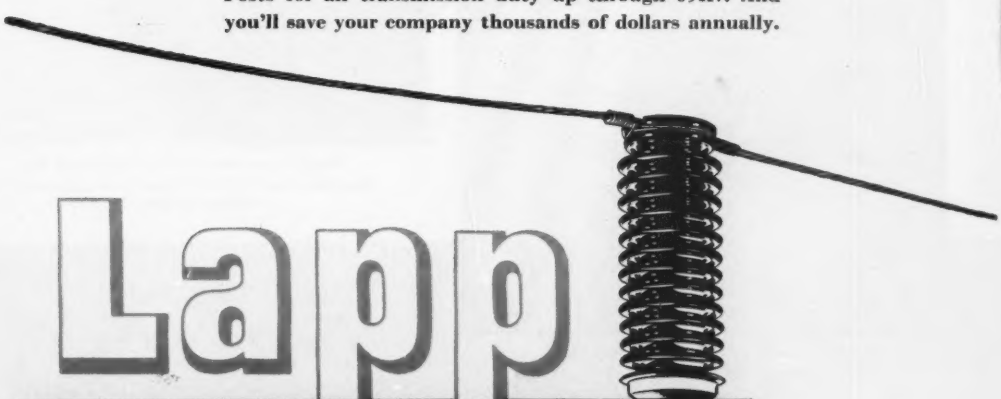
Remember this Ad

Next time you get a bad lightning storm...

Maybe you think your company has "no trouble" with transmission insulators... How many pin-type insulators do you suppose had to be replaced as the result of your last bad lightning storm? Just "normal" replacement, you may think; "Every piece of equipment calls for a certain amount of maintenance, and insulator costs are low."

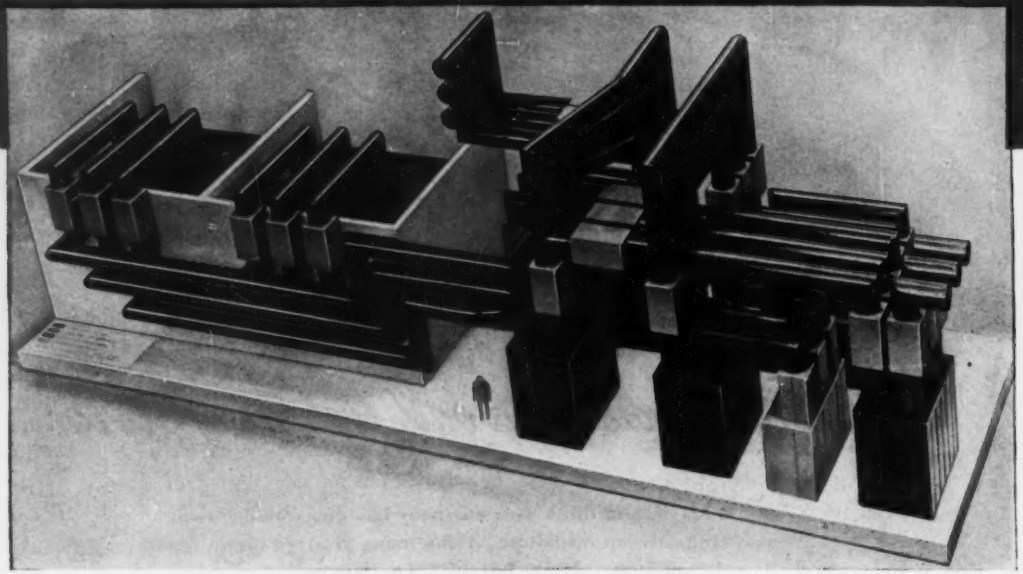
We strongly urge you to take a critical and detailed look at those "normal" transmission insulator maintenance costs. We predict that you'll find it a whale of a lot bigger expense item than you suspect. What's our reason for wanting you to know just what that cost item is?

...why, we've got an insulator with a proved record of ability to cut that expense to a tiny fraction of what it now is. The Lapp Line Post. We think that if you'll make a fair comparison of maintenance costs, you'll standardize on Lapp Line Posts for all transmission duty up through 69Kv. And you'll save your company thousands of dollars annually.



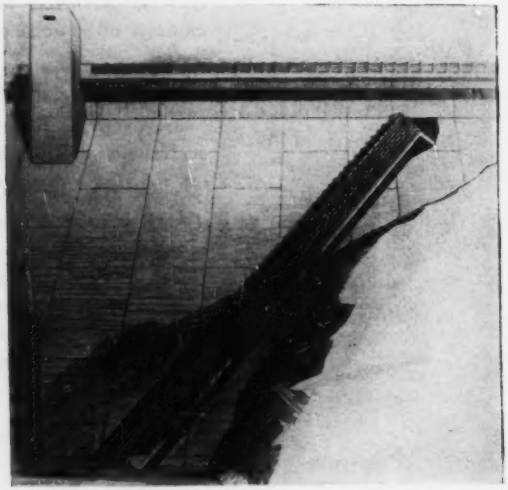
Lapp

LAPP INSULATOR COMPANY INC., LEROY, NEW YORK



Scale Model 69 KV Distribution Bus — Consolidated Edison Company

4000 Ampere 15 KV Isolated Phase Bus



Artist's Conception Grand Coulee Pump Bus
Each bus feeds 2—75,000 Horse Power Synchronous Pumping Motors

First in 1936

EXPERIENCE?

AMPERE RATINGS	1200	to	7000 Amperes
VOLTAGE RATINGS	5000	to	69,000 Volts
INSTALLATIONS (72, over 100,000 KVA: Generators, Transformers, Distribution Buses, Main Buses)			213

$17,100,000

24 MILES

PLANT INVESTMENT

SINGLE PHASE FOOTAGE

Write for I-T-E Catalog 10147 for complete information on uses, construction and installation of I-T-E Isolated Phase Bus Structures, as well as convenient data and suggestions for planning a bus layout. Or ask your local I-T-E representative for information. He will be glad to help you.

I-T-E

ISOLATED PHASE BUS STRUCTURES

Dead-end Wires the Modern Way—

Use **KEARNEY** CON-NEC-TITES with Spacers

The trend toward the use of connectors for dead-ending wires has been accelerated by the introduction of the serrated spacer-washer. Because this washer adds approximately 60% to the holding power of a Con-Nec-Tite, dead ends can now be accomplished with the use of only one Con-Nec-Tite with spacer, where formerly two and three were used.

Here's the NEW **KEARNEY** PRESSURITE CLAMP

FOR PERMANENT HIGH PRESSURE TAPS

The casting of this compact, two-bolt design is made of high-strength bronze alloy with bolts of silicon bronze. It is available for use with copper or aluminum conductors from 1/0 to 1000 MCM and can accommodate two maximum size cables, or one maximum size and any smaller size to a minimum of No. 8 A.W.G. solid. Shakeproof washers prevent loosening under vibration.

Complete data is available — just write for Bulletin No. 12-12.

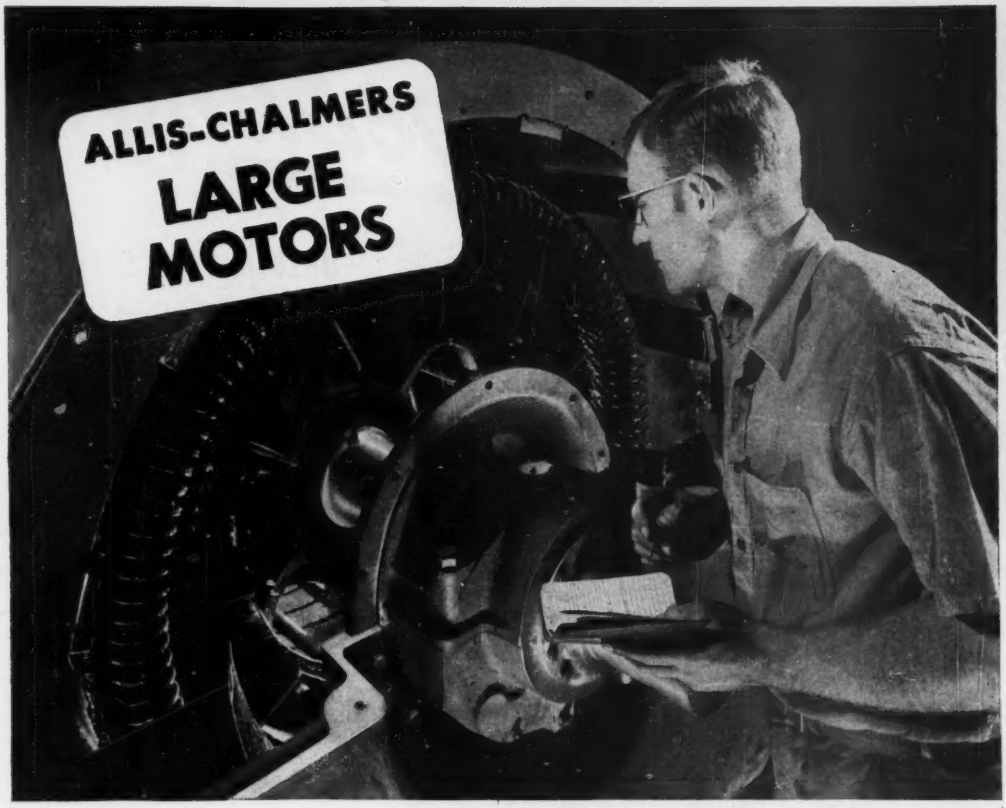
JAMES R. KEARNEY CORPORATION ST. LOUIS, MO.

JAMES R. KEARNEY CORPORATION
4224-42 Clayton Avenue, St. Louis 10, Missouri

BETTER CONSTRUCTION *Safer* MAINTENANCE

R&IE

SWITCHGEAR • UNIT SUBSTATIONS • ISOLATED PHASE BUS STRUCTURES • CIRCUIT BREAKERS • MECHANICAL RECTIFIERS • [illegible] • SPECIAL PRODUCTS



HOW'S THIS FOR Accessibility?

ONE MAN can perform all routine maintenance jobs on this brand new line of Allis-Chalmers large motors. He can remove the upper halves of the end brackets and air baffles and reach right inside the motor with his vacuum cleaner or air hose. There is plenty of room to reach up back of the stator core through air discharge openings in the stator yoke.

Bearings Protected

The capsule-type sleeve bearings need not be opened up and exposed when the end bracket halves are removed. The bearings are protected from abrasive dust and dirt while the motor is being cleaned. This eliminates the work usually required to dismantle the bearing, clean and reassemble it during routine maintenance.

Easy Installation

Large stator air discharge openings with removable louvers allow ample room to use an electric or air drill for doweling and bolting the motor to the foundation. These large discharge openings plus adequate air intake openings in the end bells provide cooling air at low velocities.

Sleek Appearance

You'll be proud of the appearance of the new Allis-Chalmers motor in your plant, too. Clean, simple lines and smooth contours give outward confirmation of its inner strength.

These new design Allis-Chalmers drip-proof and splash-proof bracket bearing squirrel-cage induction motors are built in sizes from 60 hp at 300 rpm to 1500 hp at 1800 rpm. Ask your Allis-Chalmers representative to show you the details of this exceptional new motor or write Allis-Chalmers, Milwaukee 1, Wisconsin for Bulletin 05B7542. A-3251

A-C ALLIS-CHALMERS

ALLIS-CHALMERS

Today it's Roebling!

Unsurpassed service at lowest cost with Roebling Paper Insulated Cable

YOU NEVER WANTED ECONOMY MORE than you do today . . . and you'll get it by putting circuits underground with Roebling Paper Insulated Lead Encased Cables! No more unsightly overhead lines with their expensive upkeep . . . trouble-free service, uninterrupted and dependable, is yours for years on end.

Roebling Shielded Type H is outstanding for 3-phase grounded neutral circuits from 13 to 33kv. It is available in single and multiple conductor construction, in regular and Compack strand (round or sector). Conductors are shielded with metallized paper, individually insulated, protected with perforated copper shielding tape, and the whole assembly served with a bronze binder tape and lead sheathed. Similar assemblies can be made to your special specifications.

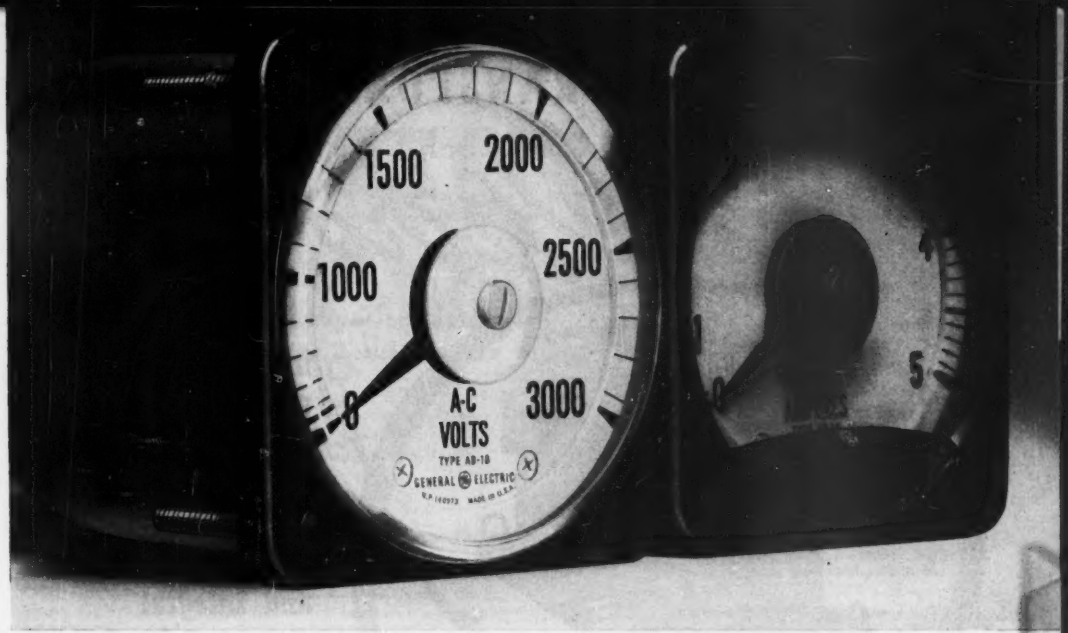
Your nearest Roebling office and sales engineer will be glad to help you select the *right* cable for top performance and economy. John A. Roebling's Sons Company, Trenton 2, New Jersey.

There's a Roebling electrical wire or cable for practically every transmission, distribution and service requirement. All of them are made completely in Roebling plants where the most modern techniques and precision machines assure products of the very highest quality.

ROEBLING

A CENTURY OF CONFIDENCE

Atlanta, 934 Avon Ave. ★ *Boston*, 51 Sleeper St. ★ *Chicago*, 5525 W. Roosevelt Road ★ *Cincinnati*, 3253 Fredonia Ave. ★ *Cleveland*, 701 St. Clair Ave., N. E. ★ *Denver*, 4801 Jackson St. ★ *Houston*, 6216 Navigation Blvd. ★ *Los Angeles*, 216 S. Alameda St. ★ *New York*, 19 Rector St. ★ *Philadelphia*, 12 S. Twelfth St. ★ *Portland*, 1032 N. W. 14th Ave. ★ *San Francisco*, 1740 Seventeenth St. ★ *Seattle*, 900 First Avenue S.



Both instruments are lighted from above. Note how much easier you can read the new dial.

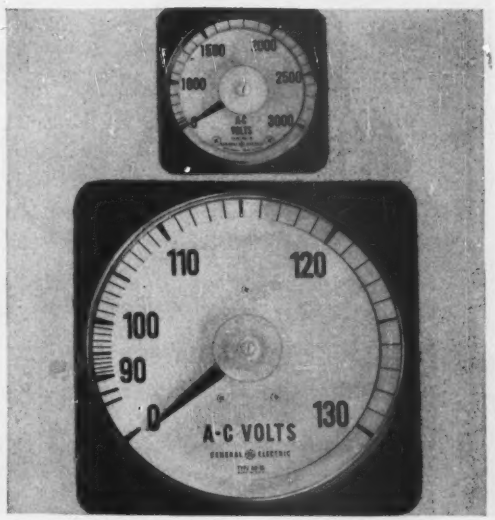
COMPARE THE READABILITY!

Shadow-proof dial makes new G-E instrument easier to read

Two new lines of switchboard instruments—4¼- and 8¾-inch sizes—have just been introduced by General Electric. Here are new instruments you can *read*—always. No more shadows caused by overhead lighting. No more cover overhang. The dial is set forward, flush with the front of the case, and a protruding convex-type glass front provides clear illumination from any angle. Anti-glare glass prevents reflections. Even when the lighting angle is sharp, you can easily read these instruments.

You can obtain shadow-proof instruments in both sizes as ammeters, voltmeters and wattmeters; frequency and power-factor meters; temperature indicators and synchroscopes.

Specify General Electric shadow-proof instruments for control stations, testing devices and other installations. Ask your G-E representative today for more information or write for bulletin GEC-218B, Apparatus Dept., General Electric Co., Schenectady 5, N. Y.



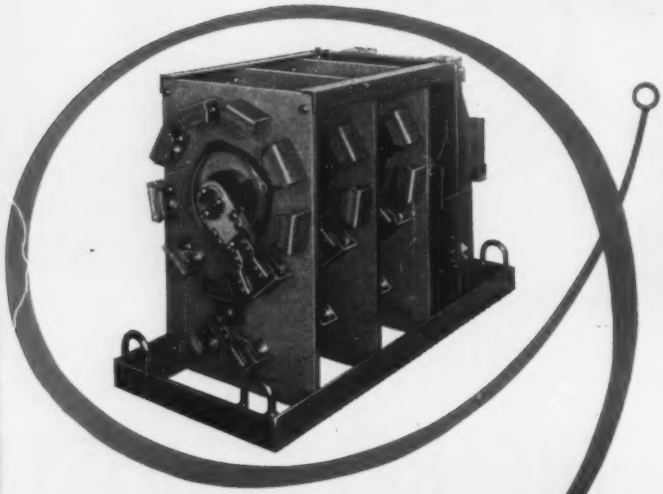
AVAILABLE IN TWO SIZES. Type AB, DB-18 is 4¼ in. square, 250-degree scale, 7.1 inches long. Type AB, DB-16 is 8¾ inches square, 250-degree scale, 14.2 inches long. Both have 1% accuracy.

GENERAL ELECTRIC

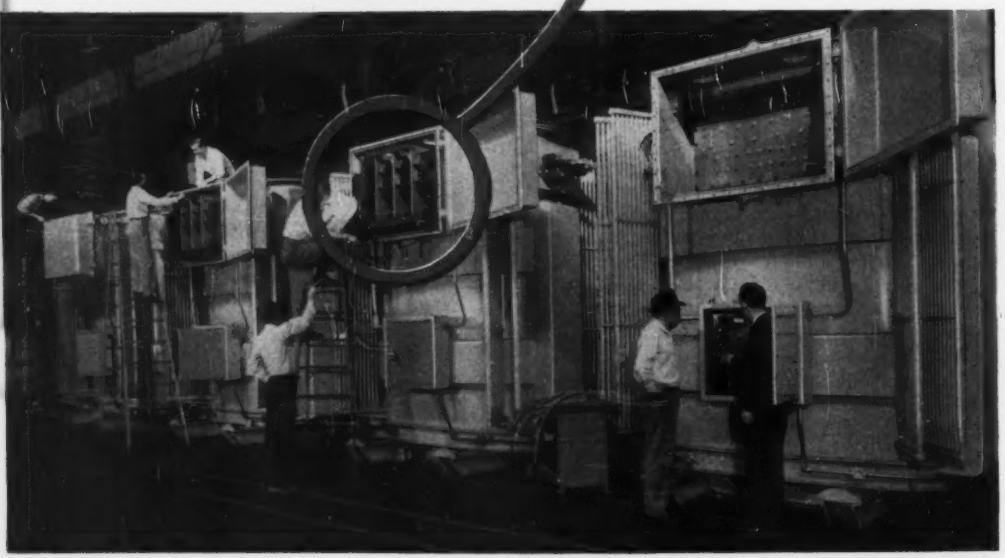
602-191

PENNSYLVANIA TRANSFORMER COMPANY

Introduces



for Pennsylvania Load Ratio Control Transformers, Step Voltage Regulators, and Integral Unit Substations.



Pennsylvania TRANSFORMERS

Pennsylvania TRANSFORMER COMPANY

CANONSBURG, PENNSYLVANIA • *Greater Pittsburgh District*

*PENNSYLITE

An outstanding, new, low power factor, low loss dielectric material, developed expressly for Pennsylvania Underload Tap Changers.

WHAT IS PENNSYLITE

Pennsylite is a low power factor, low dielectric loss, laminated material developed expressly for the panels in the switch assemblies of Pennsylvania's 16 and 32 step Underload Tap Changing Equipment.

WHY WAS PENNSYLITE DEVELOPED

It is no secret that difficulty has been experienced with existing fabric base and paper base laminates. Most of this difficulty has been traced to entrapped gas sealed within the cured laminated structures. These gas voids increased the power factor and dielectric loss of the laminates and resulted in laminates having erratic voltage strength. Under electrical stress, voltage found its way through the void structures parallel to the laminations destroying the insulating value of the laminates.

PENNSYLITE ELIMINATES THIS PROBLEM

Pennsylite combines the best electrical properties of low loss paper-base laminates and the best mechanical properties of fabric-base laminates.

A specially treated, fine weave fabric and low loss thermal setting resin binder make Pennsylite a homogeneous laminated structure free of gas voids.

NO VISIBLE DIELECTRIC FATIGUE

A continuous 90 KV voltage was applied to Pennsylite step voltage regulator panels for straight periods of many days duration. No disturbances or failures resulted. Radio Influence Voltage Tests indicated exceedingly low microvolt levels, showing that ionization leading to corona was not evident.

WHAT ARE THE OUTSTANDING QUALITIES OF PENNSYLITE

1. Low 60 cycle power factor (1.5 to 4% at 20°C.) when received from supplier.
2. Ability to withstand test voltages continuously applied parallel to laminations for an extended period of time.
3. Will not delaminate or split parallel to laminations when exposed to 120°C. continuously.
4. High impact strength perpendicular and parallel to the laminations.
5. High flexural, tensile, and bond strength.

WHAT MAKES THIS NEW DEVELOPMENT OUTSTANDING

Mechanically, paper-base laminates are weaker than fabric-base laminates. But, as a rule, the electrical properties are poorer for fabric-base laminates than for paper-base laminates. In Pennsylite, however, the best electrical properties of low loss, resin bound paper-base laminates are combined with the best mechanical properties of fabric-base laminates.

*Trademark

TO ASSURE UNIFORM DIELECTRIC QUALITY, *specifications for evaluating Pennsylite have been adopted by Pennsylvania Transformer Company and accepted by the suppliers as a standard prodedure for evaluating this new laminate.*

PROCEDURE FOR EVALUATING PENNSYLITE

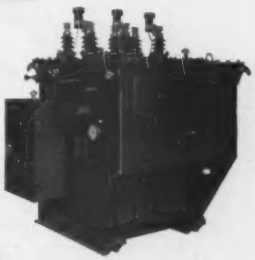
1. Measure power factor at 60 cycles, 20°C.
2. Heat in dry oven for 36 hours at 250°F. (121°C.) to check for possible blistering or delaminating.
3. Measure power factor at 60 cycles. Compare with (1). Power factor must be within prescribed tolerances.
4. Place in transformer oil 78° to 82°C. for one hour.
5. Evaluate interlaminar voltage strength. Mount 2 studs (1½" Dia) 3½" apart on a section of Pennsylite, and immerse in oil. Apply 60 cycle voltage and obtain audible and visual corona points, withstand KV and breakdown KV.
6. Check dielectric fatigue. Apply test voltages continuously for five days duration.

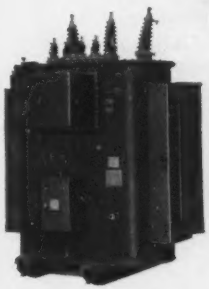
NOTE: *Each piece of Pennsylite is given a 60 cycle voltage power factor test before it is fabricated for use into a Pennsylvania Underload Tap Changer.*

YOU'LL FIND PENNSYLITE AND MANY OTHER DESIRABLE FEATURES IN PENNSYLVANIA

Step Voltage Regulators

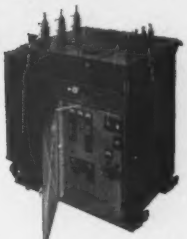
156 Kva Step Voltage Regulator. 12000 Volts. 32-⅝% taps. Total tap range plus or minus 10%.





Load Ratio Control Transformers

2500 Kva, 3 Phase, 66000-2500/4330Y x 7500/-12990Y Volts. Low Voltage winding equipped with 16-15/16% taps for automatic tap changing under load.



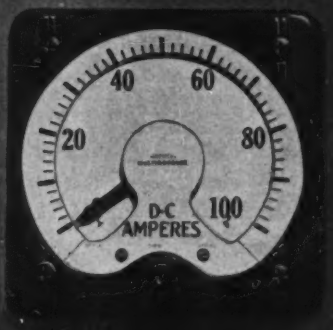
Integral Unit Substations

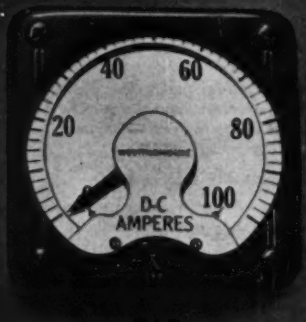
1500 Kva Single Circuit Unit Substation. High Voltage: 22000 Volts. Low Voltage: 4160 Volts. 32-⅝% taps on Low Voltage winding.

YOU CAN BE **SURE**.. IF IT'S

Westinghouse

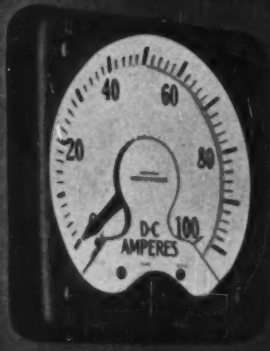
GREATER HEAD-ON READABILITY





OLD

GREATER ANGLE READABILITY



NEW

OLD

The New, Full-View Type K-24 is another example of the constant effort Westinghouse is making to meet customer requirements for better instruments. It is typical of the extreme attention that goes into every detail . . . *for better performance and better usability.*

FROM *ANY ANGLE*

Easier, quicker Instrument Read-Ability

Here's the new switchboard instrument that you've been asking for and hearing about! Developed by Westinghouse in co-operation with customer engineers . . . to meet user suggestions and requests . . . it brings a new concept of instrument read-ability. Again Westinghouse leads the way in the instrument field . . . another step that helps you get more for your instrument dollar.

GREATER READABILITY . . .

The Full-View K-24 line is the easiest reading instrument on the market. New improved dial and open face direct attention instantly to the scale divisions and pointer. You will take measurements quickly . . . accurately . . . from greater distances . . . from greater angles. The possibility of reading errors is reduced to an absolute minimum . . . no waste of time in "walking over" to take a reading.

ELIMINATES SHADOWS—REDUCES GLARE . . .

The full, open window and unique dial structure prevent shadows on the scale, regardless of lighting conditions. The flat, single window surface keeps the problem of glare under control. These features eliminate distortion and confusion . . . eyestrain is minimized . . . operator satisfaction is assured.

INTERCHANGEABLE . . .

Panel drilling dimensions are identically the same as the superseded design. ASA mounting dimensions are maintained. All parts are interchangeable with those in the superseded design.

Westinghouse has this line of instruments ready for you now. Insist on it for your next control board job. For complete information, ask your Westinghouse representative for Catalog Section 43-200. Whatever your electrical measuring requirements, ask for the planning help of a Westinghouse Instrument Specialist. Westinghouse Electric Corporation, 95 Orange St., Newark, N. J.

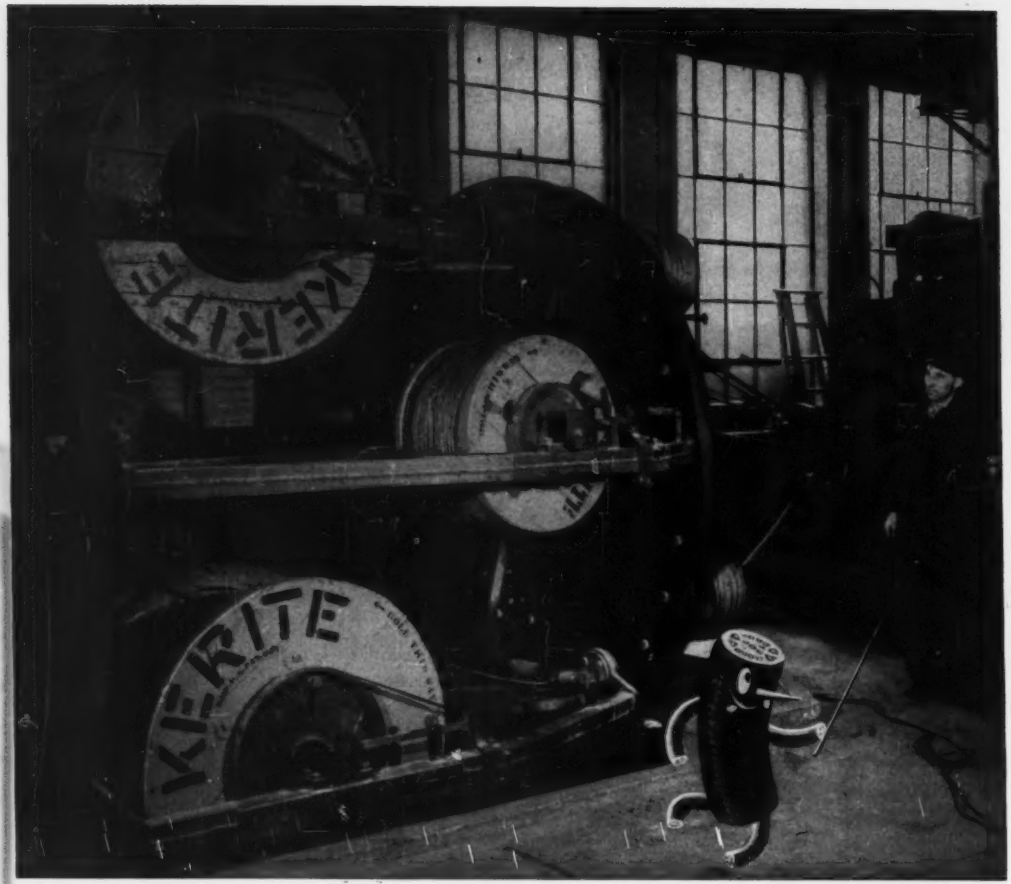
J-40393

Specify Westinghouse *- get more for your instrument dollar!*

Westinghouse

INSTRUMENTS

WESTINGHOUSE



Conscientious Workmanship

protects the long life inherent in Kerite Cable

KERITE Cable is produced under skilled supervision by craftsmen whose fathers and grandfathers worked on Kerite Cable that is still in operation today.

Improved methods are constantly being developed at Kerite, but quality and integrity of manufacture are always the main considerations. Fine engineering, conscientious workmanship, and proper handling combine to protect the long life that is inherent in all Kerite Insulated Cables.

Kerite engineers will be glad to help you with your cable problems, whatever they may be. THE KERITE COMPANY, 30 Church Street, New York 7, N. Y. Offices also at 122 S. Michigan Avenue, Chicago; 582 Market Street, San Francisco; 714 W. Olympic Blvd., Los Angeles.

DAYS KERITE

KERITE CABLE

Kerite Insulation—Your Cable's Best Life Insurance

Use Management Efficiently

Just ten years ago the country was facing an emergency similar to that which is ahead. In 1941 the industry's plans called for the largest capital budget on record, a total of $650 million. An increase in sales of 19% or 22 billion kwhr was predicted along with capacity additions of 3 million kw.

In the previous year, 1940, a moderate expansion had taken place in capital expenditures of $600 million and capacity additions of 1.7 million kw. At that time ELECTRICAL WORLD said,

"The orders for electrical materials apparatus and supplies in 1940 are the largest ever booked in a single year. The electrical manufacturers as a whole are entering the new year with a record-breaking backlog of orders. The schedule for 1941 delivery of generating equipment sets a new all-time high. The utility construction budget for 1941 will be a quarter more than 1940 and the largest since 1930.

"There is every reason to believe that load will will continue to expand, especially industrial; but if priorities are widely invoked, some estimates may have to be revised. We maintain, however, that with or without priorities there will be no power shortage.

"In order to increase defense production there may be some labor shifting to permit the employment seven days a week of machinery and factory space. This, of course, would have the effect of increasing kilowatt-hour consumption without increasing the peak."

Thus in 1940 the electrical industry was preparing for war in its normal efficient manner as it is in the current period. But in 1950 the activity was much more feverish than that in 1940. An industry that went through the experiences of the last war and the postwar period could not afford practical conservatism. Bold action was the immediate response to the demands of war in Korea.

Whereas in 1949 the industry ordered 4.2 million kw of generating capacity, 13.5 million kw were ordered in 1950. The backlog of orders increased from 14 million kw to 20 million kw. Estimates of industry growth have doubled in kilowatt hours and increased 50% in peak. The rush to place orders is on the wane. Sales of appliances which reached the record high of $7.2 billion will drop appreciably. It will be hard to break the record increase of 39 billion kwhr in output and 6 million kw in peak. But nevertheless 1951 will be another near record year.

Whereas the estimated capital expenditures in 1950 by all utilities were $2.9 billion, the budgets for 1951 will total nearly $3.2 billion. But the availability of materials may seriously curtail this expansion program. In the long run, however, the planned capacity additions to all electric systems and the new facilities for expanded metal and the atomic energy programs must be completed.

The important goals ahead are the efficient and economical installation of facilities, preservation of a trained work force, maintenance of financial stability, and coordination of power system additions with the needs of industrial mobilization and expansion. Qualified management for these important tasks is available. Efficient use of such talent must be an additional goal. These things being accomplished, the industry will in 1951 be even more deserving of praise than in the same period a decade ago when similar activities prevailed.

Goals

January 1 is the time-honored occasion for New Year's resolutions. Such an annual pledge to oneself is often an aid in building moral stamina. It seems fitting, therefore, that many electric power companies pick this time to publish their "goals" for not only 1951 but for the entire future of the industry, however long that may be.

The list of goals cover all of the major objectives of the power companies in providing service, contributing to human welfare, assuring equity in treatment for all consumers, and promoting American prosperity.

In principle and without regard to some ideological differences, it seems that the "goals" adopted by the power companies could become universal for all electric utilities. If such were the case, these are the simple statements upon which each would have to agree:

To foresee the needs of each community for electricity and to provide it at the lowest rates which will assure abundant power and satisfactory service.

To work loyally for the growth and betterment of each community served.

To attract and hold well-trained, competent employees by paying good wages and providing the best possible working conditions.

To seek equal treatment of all users of electricity, and to that end, to work for the revision of laws, regulations, and governmental practices that favor one user over another.

To urge equality in taxes.

To encourage efficient development of the nation's land, water, and atomic resources for the benefit of all.

Mobile Stations Versatile

Around the corner may be a period when mobile substations will be indispensable aids to sustained service in important districts and to important munitions producers. Any decision to be forehanded by providing enough of them to meet probable exigencies can well be predicated on the thesis that these equipments are capable of much wider use than most of them get. There is thus no valid reason to worry that investment in them would be solely for security purposes nor that they would be standing idle while waiting for an emergency call.

They could be kept profitably busy beyond such customary use as for replacing a damaged transformer. They permit deenergizing an entire substation so that beneficial changes can be made or the structure painted with safety. They can augment an inadequate station while awaiting delivery of an appropriately large transformer.

Most of the units may require a day to set them up and another day to disassemble them. Add this time to the hours per year in service for each specific purpose and one has the basis for a study of the probable risk of finding the equipment tied up when needed more elsewhere.

The answer lies in such facts as indicated. The point is to keep records that convey such facts. Study of these data will almost surely reveal that more use can be made of existing units than is now derived. They can function in numerous ways to maintain both customer service and utility revenue without sacrificing their availability for serious situations. The same data can indicate whether additional mobile units could pay for themselves now and still be extremely useful in case of national emergency.

Ground Neutral of Capacitors

"Delta connected capacitors served from a 4-wire wye system are risky because a phase-fault may result in resonant overvoltages and burnout of lamps and motors." That assertion is a repetition of a Technical Note item in the Nov. 6 issue. It was questioned by some, but there is ample substantiation of the warning.

If the phase-fault is an open such as might happen if a vehicle crashed a pole, the unbroken phase would have a capacitor and a transformer primary in series between it and neutral. Should two of the three phases be open, the live phase would energize both because the same series setup of capacitor and transformer winding exists on the otherwise deenergized phase.

How much voltage would be applied to the transformers is problematical unless the relative impedances of the capacitor, transformer, and secondary load are known. The quadrature relationship can result in serious rise in voltage—possibly up to double.

This is no academic matter. Large numbers of lamps, radio transformer and distribution arresters have been destroyed under just such circumstances.

The remedy is simple—connect the capacitors in wye and connect its junction to the feeder neutral.

A Good Policy to Follow

A public relations policy is like an insurance policy—neither is any good until you need it, and then it is too late to get one if you haven't already done so. The recent windstorm that swept the Eastern states proved this.

Several years ago a severe sleet storm swept the same area. The howls of customers without electric service were echoed in and by the daily press. There was even talk in New Jersey of compelling utilities to put all lines underground. Several weeks ago when the windstorm deprived even more customers of electric service there were few complaints. And many companies got a pat on the back editorially from local papers for their good work in restoring service.

What made the difference? Just this—profiting by their mistakes in 1948, the companies established a public relations policy or improved the one they had. When the recent storm occurred they cashed in. It is smart for utilities to check their public relations policy along with their insurance policies. They may be needed sooner than expected.

The Electrical Week

IN WASHINGTON—C. Girard Davidson, a leading federal power spokesman, has resigned as Assistant Secretary of the Interior (p 39) . . . At long last there is a Defense Power Administrator. He is Clifford B. McManus, president of Georgia Power Co and its parent, the Southern Co (p 40) . . . The Federal Power Commission has rejected the application of the Power Authority of the State of New York to develop the St. Lawrence for power. Instead FPC urged the federal government to speed action on both the power and the seaway aspects of the project (p 41) . . . The FPC has reelected Thomas C. Buchanan as its vice chairman (p 41) . . . The Senate Appropriations Committee told Sepa and the National Advisory Committee for Aeronautics to do business with the Virginia Electric & Power Co instead of seeking federal funds for a transmission line from Buggs Island to Langley Field, Va. (p 42) . . . Secretary Chapman has told the embroiled Nebraska public power groups how he will market Missouri Basin power (p 43).

ELSEWHERE—The American Gas & Electric Co is adding 1 million kw to its system to provide power for the many defense industries being located in its area (p 38) . . . Charging that American Power & Light is planning to sell its Washington Water Power common stock to the Chelan PUD No. 1, a group of business men have gone to court to enjoin the deal which both parties have denied. But the PUD has made a deal with Puget Sound Power & Light to lease and expand its Rock Island Plant (p 44).

• • •

Eighty Central Maine Power Co linemen recently changed the configuration on 325 poles between West Paris and Bethel in a single night. The job involved removing the top arm, installing a ridge iron, pin and insulator, and re-tying all the wire to reduce sleet hazards. A 4.5-hr. interruption was scheduled.

The battle to build an electrically driven belt line across Ohio will be renewed in the next session of the state legislature. The belt line company is seeking the right of eminent domain as a public carrier. The railroads are opposed. The belt line would haul iron ore from Lake Erie to the Ohio River and coal in the opposite direction.

W. A. Graham, a 99-year-old banker, has purchased $180,000 in bonds being sold to enable Pryor, Okla., to purchase its electric distribution system from the Public Service Co of Oklahoma. Previously he had donated $100,000 to the city to help it make the purchase.

Vice President T. H. Buckley, Public Service Co of New Hampshire, has told the state utilities commission that if revenue from appliance sales is to be included in operating income, the $2.5-million working capital in the rate base would have to be increased by about $700,000, divided about equally between merchandise inventories and receivables.

Trackless trolley development is progressing steadily in design and application. Boston's initial installation of 6 units 15 years ago has risen to 340, and 90 more are scheduled for 1951 service.

New plant and equipment expenditures continue to soar. SEC estimates that electric and gas utilities made outlays of $3,220 million in 1950, a record high surpassing 1949's total of $3,140 million. And the first quarter '51 estimate is $740 million, topping first quarter '50 total of $650 million.

Radiant floor panel heating with automatic controls has reduced absences of pupils because of respiratory ailments in one year by 14%. The installation is in a Bellflower (Calif.) school where the previous absence rate for such causes had been high.

Notes From The News

Dedication of the Bureau of Reclamation's Anderson Ranch Dam on the south fork of the Boise River, Idaho, will be delayed until next spring. The ceremonies had been set for Nov. 20 but were postponed because of mechanical failure which developed in the first electric generator during a test run. The generator went into operation last month, but hazardous driving conditions not likely to improve before spring have caused the postponement of the dedication . . . Consumers Power Co is giving all employees who drive company vehicles driving tests, including physical examinations, psychophysical, written, and practical road tests. Aim of the program is to curb personal and property damage accidents . . . Tennessee Valley Authority has reported that 200,000 persons visited its 15 major dams in November. The dams are now closed to the public for security reasons for the duration of the national emergency. A private utility, Philadelphia Electric Co, also has closed its plant facilities to visitors for the same reason . . . Local custom marked the installation of a new generator of the Sudan Light & Power Co in Africa. A ram was sacrificed, and the new engine marked with its blood.

AG&E's Job—More Power for Defense

System Is Adding Million Kw at 3 Steam Plants to Supply Energy for Basic Industries That Will Be Located in Its Service Area

American Gas & Electric Co is girding for an all-out defense effort. Its job to provide power for defense industries, superimposed upon its peacetime demands, is and will be particularly strenuous because of its location in the very heart of the country's principal arsenal.

Defense Plants Being Built

In this extensive area in which the most diverse and some of the most strategic basic industries now operate, new defense plants are being built and more are going to be built. These produce or will produce such defense materials as coal, steel, aluminum, rubber, chlorine, nitrates, and scores of finished products. All require additional or new big blocks of power at a time when power facilities are already heavily loaded. Nevertheless, it is AG&E's big job to supply it, and this means building more power generation facilities, more transmission lines, more substations, and getting the money to finance this construction.

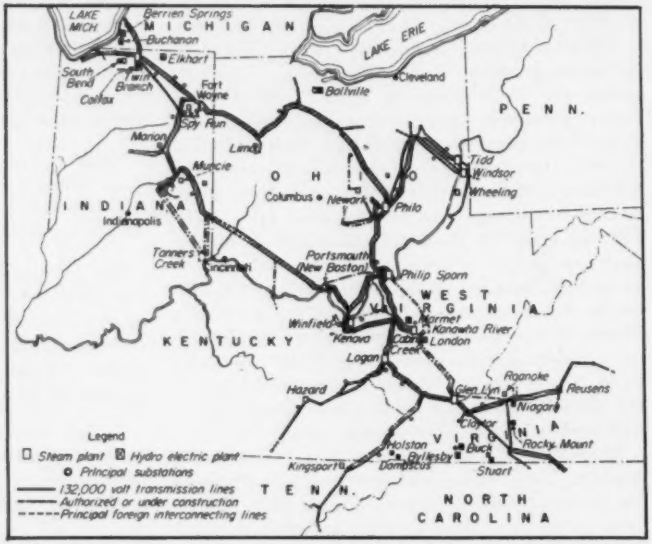
Construction Being Stepped Up

AG&E has been expanding its capacity since World War II ended. Now the construction program has been stepped up. At present, it has 1 million kw of new capacity under construction in three steam plants. Several months ago at Glasgow, W. Va., one of its subsidiaries, Appalachian Electric Power Co, broke ground for the initial 400,000 kw of the 1-million kw Kanawha River Plant. The first 200,000-kw unit, the largest of its kind in the country, will go into operation in October 1952, the second in March 1953.

At Graham Station, W. Va., Appalachian and Ohio Power Co, another AG&E subsidiary, are doubling the capacity of the presently operating 300,000 kw of the projected 900,000-kw Philip Sporn Plant. The No. 3 150,000-kw unit will go on the line in June 1951; No. 4 in December of the same year.

Another subsidiary, Indiana & Michigan Electric Co, will have the first 150,000 kw of the projected 900,000-kw Tanners Creek Plant on the line in a few months; the second unit is under active construction and slated to be completed early in 1952.

These new units will increase AG&E capacity to a total of 3,380,000 kw. Most of it, or 3,160,000 kw will be in ten major steam plants and in one hydro plant. The remainder will be in some 30 small steam, hydro, and internal combustion plants.



MAP shows the extent of the area served by the American Gas & Electric System

Capacity of AG&E System

MAJOR STEAM PLANTS

Plant	Location	Capacity (Kw)
Twin Branch	Mishawaka, Ind.	393,000
Philo	Philo, Ohio	410,000
Tidd	Brilliant, Ohio	210,000
Windsor (Ohio Power part)	Power, W. Va.	145,000
Philip Sporn	Graham Station, W. Va.	300,000
Cabin Creek	Cabin Creek, W. Va.	305,000
Glen Lyn	Glen Lyn, Va.	185,000
Logan	Logan, W. Va.	87,000
Kenova	Kenova, W. Va.	40,000
Total		2,075,000

MAJOR HYDRO PLANT

Claytor	Radford, Va.	75,000
Total capacity of all major plants		2,150,000
Total capacity of all minor plants		230,000
Total system capacity		2,380,000

MAJOR STEAM PLANTS UNDER CONSTRUCTION

Tanners Creek	Lawrenceburg, Ind.	300,000
Philip Sporn	Graham Station, W. Va.	300,000
Kanawha River	Glasgow, W. Va.	400,000
Total major capacity under construction		1,000,000
Total system capacity by 1953		3,380,000

Disposing of the output of this system or the serving of defense industries anywhere in its area is made easy by the complete integration of the AG&E system. It was the first holding company to meet completely the integration provision of the Holding Company Act. The company's service area stretches across seven states and serves a population of over 4 million persons. AG&E operates in Michigan, Indiana, Ohio, West Virginia, Virginia, Kentucky, and Tennessee. It is one of the few private electric utility companies operating in the last-named state.

A strong point in favor of the system as the locus for important defense industries is the fact that it is a small-town system. There are approximately 2,100 communities served. Their average population is close to 2,100.

Not one has a population over 150,000. But small towns mean that

there are plenty of good sites for industrial plants. The land is available more reasonably as compared with sites in metropolitan areas, and taxes are lower. In addition, a large part of the territory is rich in coal, oil, gas, limestone, salt, clay, sand, and water. Transportation facilities are extremely good, with adequate railroads, highways, and rivers. Thus the area is a highly desirable one for manufacturing. Contiguous to all communities there are large areas devoted to farming.

System Well Integrated

Although AG&E is a holding company, it is so completely integrated that its subsidiaries operate almost as a single company. Basic power supply facilities—generation and interconnecting transmission are planned and developed on a system basis. Most of the other facilities are very closely coordinated. The American Gas & Electric Service Corp furnishes engineering and management advisory services for the system—for the six operating companies.

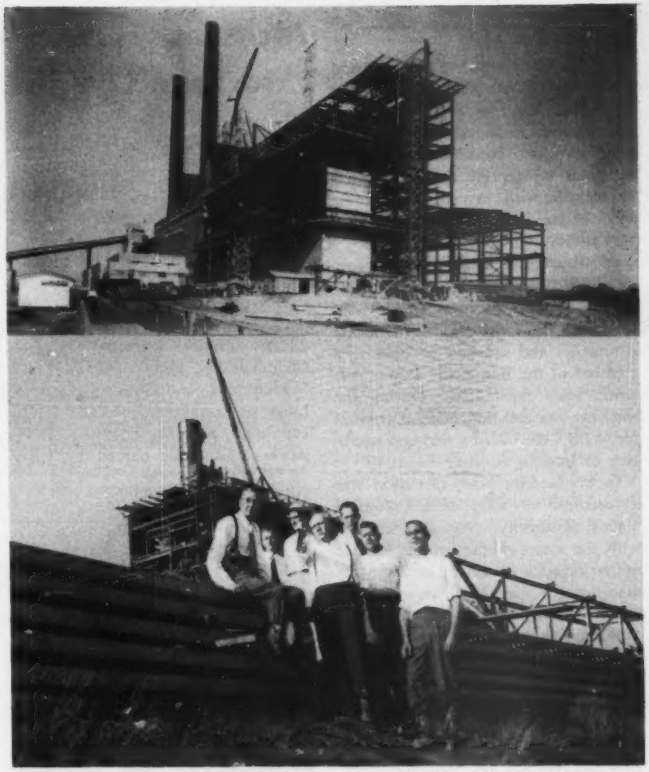
These include Appalachian Electric Power Co, Roanoke, Va.; Indiana & Michigan Electric Co, Fort Wayne; Kentucky & West Virginia Power Co, Ashland, Ky; Kingsport (Tenn.) Utilities, Inc; Ohio Power Co, Canton; and Wheeling (W. Va.) Electric Co.

Stress High Voltage Transmission

An extensive 132-kv transmission system interconnects the companies. However, the time has come for considerably higher voltages. For several years, AG&E has been conducting an extensive experimental and research program on high-voltage transmission at its Tidd Plant at Brilliant, Ohio. In the spring of 1951 the first section of a 300/315-kv line will be started connecting the Philip Sporn and Kanawha plants. The highest-voltage line in the country now is the 287-kv line from Hoover Dam to Los Angeles.

AG&E now has 1,150,000 customers of which a million are residential. Their average use in 1950 was over 1900 kilowatt hours.

Sales in 1950 will be approximately 11.8 billion kwhr as compared to 9,905,000,000 in 1949, an increase of 1,895,000,000 kwhr or 19.1%. In 1950 over 8 billion kwhr were sold to industrial and commercial customers. Revenues, keeping pace with sales, rose from $149,477,875 in 1949 to an estimated $166,300,000 in 1950.



THIRD AND FOURTH units under construction at the Philip Sporn Plant will add 150,000 kw in June and another 150,000 kw in December 1951. In lower panel, inspecting Tanners Creek construction, are AG&E officials Sidney Mitchell, director, far left; Philip Sporn, president and director, center, pointing; H. A. Kammer, construction chief; and C. H. Stockton, director, far right. Back row, left to right, are B. O. Henniger, resident engineer in charge of project; E. Snodgrass, assistant resident engineer; and E. Clapper, manager of the plant

AG&E has for years been one of the leading utilities in research. Goals have always been to increase operating efficiency and to discover ways and means for greater use of electricity. In addition to research in high-voltage transmission, the company has carried on experiments at its Twin Branch Plant to determine the practicability of effecting higher economics in fuel consumption in the steam-electric generating cycle through use of increased steam temperatures. One of the units at this plant operates at 2,300 psi. And another operates at 2,000 psi and a temperature of 1,050 F. All AG&E steam plants use bituminous coal for fuel.

AG&E has also been active for the past 15 years in heat pump research.

Davidson Resigns Post with Interior Department

A leading federal power spokesman has left the government.

Assistant Secretary of Interior C. Girard Davidson has resigned to enter private law practice in Portland, Ore. His resignation was accepted Dec. 21 by President Truman who praised the Interior official particularly for his work in the department's defense program.

Accepting Davidson's offer to 'feel free to call on me at any time I can be of service to the department," Interior Secretary Oscar L. Chapman has asked him to recommend a "unified plan which will result in the quickest and most effective develop-

ment of the great power resources" of the Northwest.

"While everyone in the region would like to see that latent power developed, there is as yet no large body of opinion united behind a single program for accomplishing this," Chapman wrote. He asked Davidson to consult with private and public agencies and individuals in the Northwest in developing a plan.

A 40-year-old native of Lafayette, La., Davidson entered the government service as an attorney with TVA. Later he was with the U. S. Housing Authority, and in 1940 he became a member of the Bonneville Power Administration legal staff. During the war, he was assistant general counsel for WPB. He became assistant secretary of Interior on June 14, 1946.

In his Interior post, Davidson was a foremost advocate of a Columbia Valley Authority. He also clashed with the views of the private electric utility industry in serving as a spokesman for the Fair Deal campaign to bring federal power to New England.

When Chapman succeeded J. A. Krug as Secretary of Interior on Dec. 1, 1949, Davidson was prominently mentioned as a candidate for the position of Undersecretary of Interior, left vacant by Chapman's promotion. This job has not yet been filled, and in a departmental reorganization Davidson was named assistant secretary for minerals, with water and power assigned to Assistant Secretary William E. Warne. A letter supplementing the broad designations stated that Davidson would continue to be the department's spokesman for CVA.

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Named to State Council

Eight public utility executives have been appointed members of the advisory council on civil defense by Gov James Dever of Massachusetts. These include Howard J. Cadwell, president, Western Massachusetts Electric Co; E. H. Eacker, president, Boston Consolidated Gas Co; H. Morris Kelley, president, Lynn Gas & Electric Co; Irwin L. Moore, president, New England Electric System; James V. Toner, president, Boston Edison Co; C. G. Young, vice president, Springfield Gas Light Co; H. A. Murphy, vice president, Stone & Webster Service Corp; and Floyd D. Campbell, president, New England G&E Association.

McManus, Georgia Power Head, to Take Over as DPA Administrator

A prominent private electric utility official this week will move into the post of administrator of the Defense Power Administration at the Department of Interior.

Clifford B. McManus, president of Georgia Power Co and its parent holding company, the Southern Co, was named to the long-vacant job Dec. 22 by Interior Secretary Oscar L. Chapman.

McManus and Pres Richard K. Lane of the Public Service Co of Oklahoma were the first two electric power consultants named by Chapman last September when President Truman delegated power controls authority to Interior. At that time Chapman declared his intention of naming an administrator from the private electric utility industry. McManus was believed to be one of a group of officials considered for the position as early as September; however, none of the group accepted the job at that time.

CLIFFORD B. McMANUS

Meanwhile, D. L. Marlett, assistant administrator of Interior's Bonneville Power Administration, was drafted by Chapman to head the power controls operation. Marlett worked with industry consultants and federal officials in planning the defense power organization which was formally established Dec. 4 by Chapman as the Defense Power Administration.

As the first formal head of DPA, McManus arrives at an uncertain period, with the shape of controls organization in the months ahead sitting in the lap of Charles E. Wilson, recently-named chairman of the new Office of Defense Mobilization.

Announcing McManus' appointment, Secretary Chapman said that the utility executive had accepted "at considerable sacrifice." Chapman praised the work of McManus and Lane as consultants and declared, "Mr. McManus' willingness to devote more time to this important task is assuring to the nation and to all segments of the electric power industry."

McManus graduated from Alabama Polytechnic Institute in 1916 with a degree in electrical engineering and became a student engineer with Westinghouse Electric Corp. He was a junior engineer with Alabama Power Co when he entered the Army as a private in 1918. Commissioned a second lieutenant shortly before the end of World War I, McManus returned after the war to Alabama Power and was assigned to General Electric Co for special training in Schenectady. When Alabama Power leased the federal steam plant at Muscle Shoals, he was made superintendent, and later was manager of the company's northern and western divisions.

In 1927 he went to Atlanta, first as superintendent of district operation for Georgia Power Co and later as assistant operating manager and assistant to Pres W. E. Mitchell. He was elected vice president, director of operations and a member of the board in 1946. In the following year, he became president of the company and in 1949 was elected president of the Southern Co.

McManus also is a director of the Edison Electric Institute and a vice president of the Southeastern Electric Exchange.

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Utility Aids Municipal

Florida Power & Light Co went to the assistance of Fort Pierce with a mobile unit when the new unit of the municipal plant was forced to shut down by a thrust bearing failure during the pre-Christmas power peak.

ALL NEGRO CREW takes care of the new 9,000-kw Blackhall Road Power Station at Freetown, Sierra Leone. Plant has three 3,000-kw generators; uses oil for fuel

FPC Backs Federal Development of Power Project on St. Lawrence

St. Lawrence power development has been referred to Congress with a new recommendation for federal construction of both the seaway and power project "at the earliest possible date."

The new St. Lawrence appeal came as the Federal Power Commission rejected the application of the Power Authority of the State of New York to develop power on the American side of the river. The commission decision to reject the New York application and recommend federal action was made Dec. 19 on a 3-1 vote, with Commissioner Nelson Lee Smith dissenting. Smith urged licensing the state body, while Chairman Mon C. Wallgren and Commissioners Thomas C. Buchanan and Harrington Wimberley sided with federal development. Commissioner Claude L. Draper did not participate in the decision.

The FPC opinion declared that "the critical situation now facing the world calls for immediate commencement of the combined project."

Noting that the New York Power Authority application covered only the power project, the commission held that state power development would delay action on the seaway.

"The vitally important seaway," the opinion said, "would still await action by Congress if the power development here proposed should actually be constructed, and it appears to us, on the basis of the national aspects of the power development, combined with the national and international benefits to be obtained from the seaway that it is highly desirable for Congress to pass upon the proposal in its entirety rather than on a piecemeal basis."

The majority opinion said that "consideration should also be given to the relationship between the marketing of power from the St. Lawrence project and the additional power potentialities of the Niagara River in the west and the undeveloped water power of the New England states to the east." State development, it was argued, "might not make this power available to as large an area as should be considered."

Legal status of the New York State agency also was challenged, as the commission warned that litigation might delay construction by the power authority "indefinitely" even if the federal license were granted.

In his dissent, Commissioner Smith agreed that development of the St. Lawrence was urgently needed, but he contended that licensing the state authority would speed the project.

"We have no way of knowing how much delay will result from the denial of the application for license and the reservation of the site over an indefinite period of time for possible federal development," the former FPC chairman said.

Dependable capacity of the proposed U. S. St. Lawrence power project was estimated at 700,000 kw, with some 570,000 kw available continuously and average annual energy output of 6.3 billion kwhr. At-site cost was calculated to be 1.72 mills per kwhr.

The State Power Authority applied to the commission for a federal license July 16, 1948. Presiding FPC Examiner Glen R. Lane on Dec. 19, 1949—a year to the day before the present decision—recommended that the commission deny the license and urge Congress to act.

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Jersey Central P&L Co Starts Work on Addition

Pile driving has begun for a 62,500-kw turbo-generator addition to the South Amboy station of Jersey Central Power & Light Co. The new unit is expected to be in operation in the autumn of 1952. It will increase the plant's capacity from 55,000 kw to 117,000 kw and will boost the system's capacity to 243,500 kw.

Expansion of the station includes an addition to the present building to house the generator, a cyclone furnace pressurized boiler, a coal conveying and crushing system, a circulating water chlorination system, and main transformer and substation changes.

The addition will cost $11 million and is part of Jersey Central's $25 million Community Growth Program. Population gain over 1940 in New Jersey is 16%; for the company's territory the gain is 36%.

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FPC Elects Buchanan

Commissioner Thomas C. Buchanan has been reelected vice chairman of the Federal Power Commission for the calendar year 1951. Mon C. Wallgren was appointed chairman by the President, but the commission elects its own vice-chairman each year.

Sepa Is Refused Funds for Transmission Line

The Senate Appropriations Committee has told the Department of Interior's Southeastern Power Administration and the National Advisory Committee for Aeronautics to do business with Virginia Electric & Power Co instead of seeking federal funds for the construction of a transmission line.

The committee turned down Sepa's request for $185,000 to begin construction of its first transmission line—a $6,870,000 link between the Buggs Island project and NACA's Langley Field facilities (EW, Dec. 18, p 72). The committee said that Vepco officials have testified that the company is willing and will be able to meet the Langley Field loads.

The committee advised NACA to negotiate a contract with Vepco covering its power needs at Langley. Sepa was urged to negotiate a "wheeling" agreement with the company for "wheeling" Buggs Island power which could be utilized in meeting the Langley load.

"The power companies in Texas Oklahoma, and Montana have entered into 'wheeling' agreements with the Interior Department that are satisfactory to the government and all concerned, and there is no reason why such cooperation cannot be attained between the Virginia Electric & Power Co and the proper governmental agencies," the committee report said, adding, "The committee expects this to be done and without delay."

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Buys 6 Circuit Breakers

The Cowlitz County PUD of Longview, Wash., has bought six circuit breakers for installation in its Longview and Kelso substations in order to further sectionalize electrical districts by reducing their size. Delivery of the equipment is scheduled for March.

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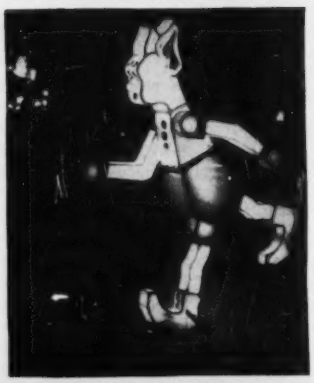
Utility to Build Plant

Northern States Power Co will start construction next year of a 40,000-kw generating plant at Granite Falls, Minn. The plant is scheduled for completion in 1953 and will supplement the 20,000-kw unit presently operating in the community.

Christmas Lighting at Nela Park

"Santa's Workshop" was the theme of the outdoor Christmas lighting displays at General Electric Co's Nela Park at Cleveland. Top and bottom views show the two illuminated trees. Picture at right is that of one of the 18 "little helpers" of Santa. These figures were 3 ft high and were made with a wire framework covered with plastic of the type used for shower curtains. Each of the figures was illuminated from its interior by 23 light bulbs.



UNITED NATIONS' building is the new neighbor of Consolidated Edison's Waterside Plant, left, on New York's East River. Empire State Building is at right

Chapman Outlines Plan for Missouri Basin Power

Secretary of Interior Oscar L. Chapman has told Nebraska's public power agencies how he intends to go about marketing Missouri Basin power in that state.

Describing negotiations among the Nebraska groups as in a "deadlock," Chapman wrote them Dec. 19 outlining his own marketing plan. Under the plan, five groups of preference customers in the state will be able to purchase Missouri Basin power from the Bureau of Reclamation. The groups are Omaha Public Power District, Nebraska Public Power System, Consumers Public Power District, customers not serviced by any of the three systems, and customers of the three systems. The latter and Consumers Public Power must make arrangements to protect the financial position of the systems they purchase power from, Nebraska Public Power in the case of Consumers.

No one of Nebraska's "preference customer" public power groups is to be given preference over another group, the secretary emphasized.

First output of an ultimate total firm capacity of 300,000 kw at Fort Randall and Garrison Dams will be available by 1954, Chapman told the Nebraska groups. While transmission systems are already programmed and under construction in the Dakotas, no plans have been made for marketing a portion of this power in Nebraska. Only Reclamation transmission line in eastern Nebraska is between Fort Randall and O'Neill, Neb.

Chapman reminded Nebraska's public power agencies that Interior established criteria for marketing Missouri Basin power more than a year ago, stating at that time that no power would be sold in Nebraska pending an agreement among the power agencies in that state. Now, it is necessary to set up a program if Nebraska is to be ready to receive power when it becomes available, agreement or not, Chapman said in establishing his own plan for Nebraska power sales by Reclamation.

City System Will Install Dampers on 2 Circuits

The Los Angeles Department of Water & Power has awarded to Hubbard & Co an order for 18,000 Stockbridge dampers to be installed on the first two Boulder-Los Angeles transmission circuits. Installation of the dampers is expected to alleviate serious increases in vibration observed on the lines last winter (EW April 17, p 4). The decision to use dampers is unusual as hollow cable has always supposedly not been susceptible of such treatment.

Bronze clamps specially designed for the hollow copper conductor and for installation with hot line tools will support the dampers. Steel cable used in the damper will have special stranding to assure the best possible performance characteristics.

Among the several bids received by the department was one from Sweden proposing a design using rubber disks between circular weights stacked on a common supporting shaft with a line clamp at the top. Some of these are being purchased for a test installation to observe their performance in the field.

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Utility to Expand Plant

Louisiana Power & Light Co plans to expand the capacity of the new Nine Mile Point steam-electric generating plant, now under construction, by adding a 35,000-kw unit. The new unit will bring total capacity to 105,000 kw.

SKELTON GRANGE STATION at Leeds, now being built by the British Electricity Authority, will have the latest developments in British engineering practice and design. Like many of the other BEA plants, Skelton will have a capacity of 360,000 kw

YIELDS (%) — Operating Electric Utility Securities

Quality	Bonds 1st	Bonds 2nd	Bonds 3rd	Preferred Stocks 1st	Preferred Stocks 2nd	Preferred Stocks 3rd	Common Stocks 1st	Common Stocks 2nd	Common Stocks 3rd
DATE									
1950									
Dec. 21	2.65	2.68	2.79	3.85	4.17	4.52	5.94	6.67	7.55
Dec. 14	2.66	2.68	2.80	3.84	4.18	4.50	6.04	6.90	7.79
END OF QTR.									
3rd 1950	2.66	2.67	2.76	3.81	4.08	4.46	5.70	6.54	7.25
2nd 1950	2.68	2.66	2.74	3.79	4.03	4.38	5.38	6.51	7.50
1st 1950	2.59	2.61	2.74	3.78	4.01	4.36	5.22	5.85	6.67
4th 1949	2.59	2.61	2.79	3.85	4.06	4.46	5.37	6.15	7.01

Data: Reis & Chandler, Inc.

Sale of Washington Water Power Stock to Chelan PUD Is Opposed

Chelan County Public Utility District No. 1 was linked with two Washington State private utilities in two separate stories in the week preceding Christmas.

In one story the PUD was linked with the Washington Water Power Co of Spokane as defendant in a suit brought by three taxpayers and users of electricity to enjoin the sale of WWP common stock to the PUD. In the other, announcement was made that the PUD would lease and expand the Rock Island hydro plant of Puget Sound Power & Light Co of Seattle.

Unconfirmed reports have been current for some time that the 2,541,800 common shares of WWP, which are owned by American Power & Light Co, would be sold to the Chelan PUD. AP&L has been ordered by the Securities and Exchange Commission to divest itself of the stock. Howard Aller, AP&L president, and the PUD officials have denied that any such sale is under consideration.

Plaintiffs in the suit, brought in the Chelan County Superior Court at Wenatchee, are Chelan Fruit Co, Charles Lund, and C. P. McKinnon. The complaint points out that 70% of WWP's customers and more than 70% of its electric plants are located in counties without PUD's. It adds that the Chelan PUD in buying the utility would be acting under a 1949 Washington law that allows PUD's to join in the purchase parts of electric utilities located outside their own districts. A suit to declare this law unconstitutional is now before the state supreme court.

Under the PUD-Puget Sound agreement the utility will make available under a long-term lease such of its structures and facilities at Rock Island as are necessary to enable the PUD to finance and install 120,000 kw of additional generating capacity. The plant is now rated at 60,000 kw.

Frank McLaughlin, Puget president, explained that this unusual arrangement is necessary for these reasons:

1. The PUD has a condemnation suit pending against the plant and related transmission lines.

2. There is urgent need for additional generating facilities.

3. Rock Island and Puget's other plants west of the Cascades complement each other. The agreement will preserve this power pool.

It is estimated that it will cost the PUD $26 million to expand the plant. Revenue bonds will finance the work.

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Seattle Recount Begun; Vote Not Likely to Change

Final verdict on the proposed purchase of Puget Sound Power & Light Co properties by the City of Seattle is expected about Jan. 22. Recount of the ballots cast in the Nov. 7 election is scheduled to be completed by then.

A citizen had asked for a court restraining order prohibiting the recount because it would "put the county to a large expense illegally and unnecessarily," but this action ended in agreements that the Election Board would recount only the power votes, disregarding votes on other issues and candidates.

The recount was ordered when apparent violations of the law in certifying the ballots cast legal doubt on the validity of 3,700 absentee ballots. However, Prosecutor Charles O. Carroll said his inquiry had convinced him that the irregularities committed by county election officials were done to expedite their work, and they had no intention of willful wrongdoing. After first appearing to have been defeated, the purchase proposition attained a 711-vote lead as errors in the unofficial tabulations were corrected.

The regional office of the Securities and Exchange Commission is investigating statements that there had been heavy trading in Puget Power stock for several days before reversal of the voting trend was indicated officially. SEC is asking Seattle brokerage houses to report all transactions in Puget Power stock between Nov. 3 and 17 to see whether there has been any violation of the Securities and Exchange Act.

FINANCIAL BRIEFS

Life insurance company holdings of public utility bonds and stocks have increased in the last fiscal year, $9,740,000,000 at the end of June, 1950, compared to $8,977,000,000 in June, 1949. However, their investments in utility bonds have not been growing as fast as those in other corporate bonds. Percentage of total assets held in utility bonds rose from 11.8% at the end of 1945 to 16.8% at the end of 1949; for other than utility and railroad bonds these figures were 4.4% and 16.3%, respectively.

Great Britain's state-owned power industry earned a surplus of $20,057,066 in the year ended last March 31. This compared with a surplus of $12,296,717 in the preceding 12 months, the first year of nationalization. The higher surplus was attributed mainly to bigger sales. Income of $600,488,000 during the year was up 8.4% from the preceding year.

Dissolution of Niagara Hudson Power Corp (EW, Nov 13, p 14) became effective Dec 21 with the filing of necessary papers with the state of New York. Niagara Mohawk Power Corp was organized last January as the successor corporation.

Competitors in Output Contest Cut from 247 to 2

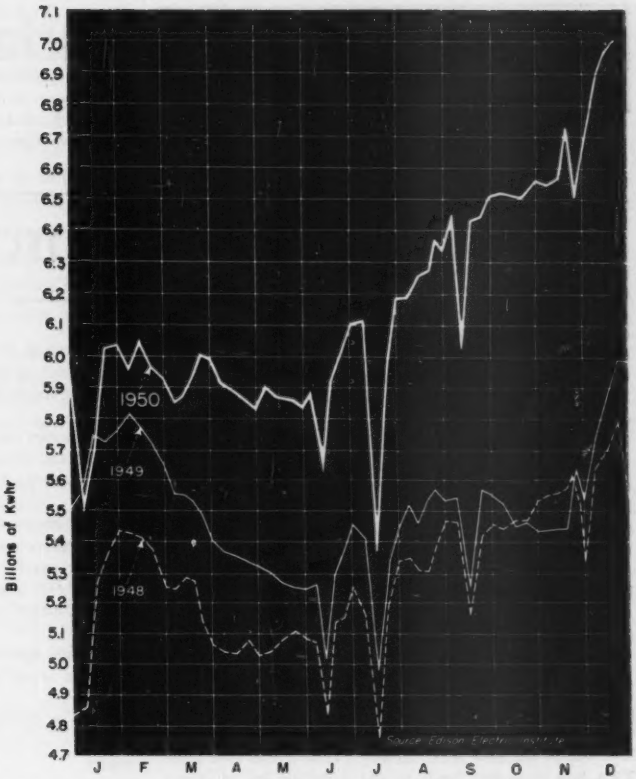
The production of electrical energy by central stations last week determined the winner of Bob Hatfield's 1950 Kwhr power generation pool. But that winner will not be announced until after Electrical World compiles its production figure for its 1950 Statistical Issue which will carry a Jan 29 dateline.

Of 247 persons who entered the contest all but two had been eliminated by Dec. 1. One of these estimated 1950 output at 325.4 billion kwhr. The other was a super-optimist who guessed 333.3 kwhr. Since late December figures indicate that the actual total will be around 329 million kwhr, the race will be a close one.

The 1950 contestants were a pessimistic lot. Though to be fair to them it must be said that they made their estimates before Sept. 1. Only 11 believed that output would top 320 billion kwhr, but 40 believed that it would be below 300 billion.

All Federal Power Commission regions but VII were represented. Estimaters included utility company presidents, other private company employees, and representatives of federal power agencies, municipals, and state and federal regulatory groups. There were also representatives of a number of manufacturers of electrical equipment and some consulting engineers.

Hatfield has been conducting the contests for a number of years. He is employed by Combustion Engineering-Superheater, Inc, at Los Angeles. At present he is on leave of absence to head the power equipment division of the National Production Authority.



Output Week Ended Dec. 23—7,032,740,000 Kwhr

Weekly Output, Millions Kwhr

1950	1949	1948
Dec 23 7,033	Dec 24 5,994	Dec 25 5,508
Dec 16 6,985	Dec 17 5,997	Dec 18 5,790
Dec 9 6,909	Dec 10 5,881	Dec 11 5,705
Dec 2 6,716	Dec 3 5,743	Dec 4 5,646
Nov 25 6,508	Nov 26 5,537	Nov 27 5,349
Nov 18 6,728	Nov 19 5,644	Nov 20 5,627
Nov 11 6,574	Nov 12 5,435	Nov 13 5,571
Nov 4 6,551	Nov 5 5,435	Nov 6 5,564
Oct 28 6,563	Oct 29 5,433	Oct 30 5,555
Oct 21 6,503	Oct 22 5,430	Oct 23 5,539

Percent Change from Previous Year

	Dec 23	Dec 16	Dec 9
New England	+12.7	+10.5	+10.0
Mid-Atlantic	+16.7	+14.5	+13.6
Central Industrial	+18.0	+18.6	+18.9
West Central	+13.5	+12.2	+15.8
Southeast	+28.2	+27.1	+26.2
South Central	+20.9	+16.5	+17.9
Rocky Mountain	+10.5	+ 9.8	+14.2
Pacific Coast	+ 8.8	+ 9.5	+14.6
Total United States	+17.3	+16.5	+17.5

MEETINGS

American Institute of Electrical Engineers
High Frequency Measurements Conference, sponsored with the Institute of Radio Engineers and the National Bureau of Standards, Hotel Statler, Washington, D. C., January 10-12; Winter General Meeting, Hotel Statler, New York, January 22-26; District No. 4 Meeting, McFadden-Deauville Hotel, Miami, Fla., April 11-13.

Public Information Program
Mid-Atlantic Regional Meeting, Hotel Hershey, Hershey, Pa., January 12.

Edison Electric Institute
Accident Prevention Committee, Lord Baltimore Hotel, Baltimore, Md., January 15-16; Commercial Cooking Committee, Conference Room, Potomac Electric Power Co., Washington, D. C., January 15-16; Electrical Equipment Committee, Hotel Cleveland, Cleveland, Ohio, February 12-13; Transmission and Distribution Committee, Atlanta Biltmore Hotel, Atlanta, Ga., February 15-16; Annual Sales Conference, Edgewater Beach Hotel, Chicago, Ill., April 2-5.

Pennsylvania Electric Association
Winter Meeting, Transmission and Distribution Committee, William Penn Hotel, Pittsburgh, February 1-2; Electrical Equipment Committee, Hotel Emerson, Baltimore, Md., March 1-2; Prime Movers Committee, Berkshire Hotel, Reading, Pa., March 8-9.

Missouri Valley Electric Association
Industrial and Commercial Sales Conference, President Hotel, Kansas City, Missouri, February 8-9; Engineering Conference, President Hotel, Kansas City, Mo., April 4-6.

Adequate Wiring Bureau
Annual Conference, Sheraton-Gibson Hotel, Cincinnati, Ohio, February 15-16.

North Central Electrical Association
Electrical Industries Convention, Nicollet Hotel, Minneapolis, February 25-28.

National Electrical Manufacturers Association
Annual Meeting, Edgewater Beach Hotel, Chicago, Ill., March 12-15.

National Association of Corrosion Engineers
Conference and Exhibition, Hotel Statler, New York, March 13-16.

Protective Relay Engineers
Annual Conference, Agricultural & Mining College of Texas, College Station, Texas, March 26-28.

Oklahoma Utilities Association
Annual Convention, Mayo Hotel, Tulsa, Oklahoma, March 29-30.

American Society of Mechanical Engineers
Spring Meeting, Atlanta Biltmore Hotel, Atlanta, Ga., April 2-5.

Electric Association of Chicago
Industrial Electrical Exposition, Sherman Hotel, Chicago, Ill., April 2-7.

Northwest Electric Light & Power Association
Engineering Section, Hotel Utah, Salt Lake City, Utah, April 25-27.

WASHINGTON COMMENT

RONALD D. ROSS

The Atomic Energy Commission's decision to divide the big power load at its new Kentucky plant between private and federal power is a significant step. Apart from the novel aspects of the proposal, this hastily evolved solution of an urgent defense power problem is certain to produce a new focal point in the arguments between federal and private power.

Here, in brief, are the facts on the new power plan. AEC decided to build a new "Oak Ridge" to step up substantially output of the fissionable variety of uranium, U-235. One of the important requirements was power supply: 855,000 kw at 100% load factor, requiring a million kw of capacity.

Originally, AEC approached both the Tennessee Valley Authority and American Gas & Electric Co about the new power supply. AG&E made a study of the problem, but transmission costs (1.25 to 1.5 mills per kwhr) priced that system out of consideration. The answer seemed to be the same one that is solving TVA's capacity problems in connection with expansion at Oak Ridge. TVA could build new steam plants.

Private Power Gets a Chance

At least one atomic commissioner, Engineer Thomas E. Murray, wasn't satisfied that the lone approach to private power—and a remote one—was sufficient. Negotiations were started with private companies nearer to the Paducah, Ky., site of the new AEC factory. Thus it was that after TVA had requested funds to add a million kw of steam capacity to meet the new load, AEC on Dec. 13 tentatively accepted an offer by a group of five private power companies to supply half the load, 427,500 kw, from a new 500,000-kw steam plant.

Five private utilities are forming the new Electric Energy, Inc. It will be an important new contribution to defense power, but it may well become much more.

Here is a new pattern for mobilizing the talents of private power for defense. It is at least a half-way answer to government planners who see new emergency loads as the excuse for more federal power development. As mobilization proceeds, other new and unanticipated loads will appear. Pooling the resources and abilities of groups of experienced private utilities to meet these new demands is certainly more sound than plunging into vast new federal power ventures. The establishment of Electric Energy, Inc, provides an example of how defense power demands can be met—and not merely 50% of them as in this case.

Fuel for Another Controversy

Sharing by TVA and Electric Energy of the new AEC requirements, too, will set off a new power controversy between the industry and its critics. There will be comparisons drawn attempting to show that one or the other of the power suppliers has given better service.

It's too early for any judgment, but the first round may be going to the industry. AEC officials testified the other day that TVA proposes to charge the commission 3.586 mills per kwhr at 95% load factor, against a comparable figure of 3.57 mills for the new utility.

These preliminary figures are the forerunner of more comparisons as this unique power program develops. Electric Energy, Inc, may provide a new "yardstick" for measuring the efficiency of TVA.

TECHNICAL NOTES

ARCHER E KNOWLTON

Electrification at 20 kv ac on a French railroad was found to cost half as much as for 1,500 v dc, but the locomotives cost somewhat more.

Small motors in electronic computing machines can be stopped and reversed to full speed in 0.002 sec; a torsion brake gives the kick in the reverse direction.

Mercury arc rectifiers in service total well over 5 million kw; there are nearly 4 million kw in the electrochemical industry; nearly a million in railway transportation and over 400,000 in mining. The latter are 2/3 sealed, electrochemical entirely pumped vacuum.

Multianode mercury arc rectifiers are being superseded by the single anode type even in the large ratings.

Banking of distribution transformers will often defer the relocation or addition of transformers to meet load increases.

Thermally operated breakers or fuses matching the transformer overload characteristics are good insurance against cascading of banked transformers.

Optimum load per substation varies approximately as the 1/3 power of voltage and cost of site and as the 2/3 power of load density, incremental cost of conductor, annual charges for money and losses. (Pierce and Poage)

Frequency multipliers for microwaves above the feasible frequency limits for crystal operation have the defect of multiplying the departures from band-center frequency.

A 960 mc system operating over a 20-mile distance with 3½-ft diam antennas will have a total loss of 100 db; that is why so many tubes have to be used to match the 20-db loss of carrier, same distance.

Grounds in mining equipment and trailing cables are detectable by an electronic amplifier tapped to a resistor between ground and the junction of three capacitors connected to the respective 220-v delta phase wires.

Power transformers bought over a 40-year period for one 115/230-kv system are still 98% in service (measured in terms of capacity); fifteen of 5 Mva have had no failure in 34 years.

100 Significant Developments of 1950

1950 was a signal year for the electrical industry. It saw the country shift from a peace to a war economy. Its 12 busy months brought to the electric utilities of the country the largest gains in output and generating capacity, the worst storm of a decade, new interest in microwave communication, buried cable distribution, outdoor and semi-outdoor power plants, fluorescent street lighting, gas turbines, higher transmission and distribution voltages and the first of an impending series of defense regulations. The year 1950 has been one of stock taking to which the editors here contribute their own estimate of the year's outstanding electrical developments

Load tripled in 15 years is the prospect ahead of the electric utilities, according to "Blueprinting the Future," an Electrical World study. May 22, p 99

To prepare for mobilization electric utilities are accelerating system expansion. Investor owned and municipal utilities to spend the all-time high of $2.5 billion in 1951. Sept. 11, p 107

Operating mistakes habitually increase during economic prosperity and decrease during depressions and wars; education can correct the tendency. Aug. 14, p 85

Series street lighting shows only slight differentials from multiple; decision usually on local factors other than economic. Nov. 6, p 96

Multiple street lighting has attracted increasing attention with better appreciation of its merits, Oct. 23, p 107

Garbage disposer installations in homes, sponsored by city government, saves municipality from expense of collection and mass disposal. Sept. 25, p 92

Range load characteristics survey shows coincident and non-coincident demands of 0.725 and 2.498 kw respectively in preliminary report. Aug. 14, p 80

Ten Southwestern electric companies asked an injunction to bar G&T loans to three super-co-ops in Missouri. Main objection of companies is plan of co-ops to lease the G&T facilities to SPA. Oct. 9, p 81, Federal attorneys asked that the suit be dismissed. Nov. 27, p 13

Buried cable offers chance to serve well-loaded residential areas with reliability at fraction of cost for underground. Nov. 20, p 103

Transformer kiosks above ground on concrete slab under metal dome for coordination with buried cable in restricted residential area. Nov. 20, p 107

Television interference more likely to arise from diathermy ignition, germicidal lamps, door-openers and dielectric heating than from power lines. Jan. 16, p 55

Economics of obsolescence and replacement cost deserve better understanding and sounder decisions by engineers. Aug. 28, p 73

Merger of Niagara Falls Power Co into Niagara Mohawk Power Corp makes latter utility largest generator of hydro power in the nation. Nov. 13 p 14

Eastern and Western Pennsylvania interconnected for the first time on June 27 when a 29-mile, 114-kv line was placed in operation. The line connected Pennsylvania Electric Co with Metropolitan Edison Co July 10, p 6

Turbine-generator of 100 Mw operated in 10 months from setting of initial steel because construction was mechanized and coordinated. Sept. 25, p 98

Weekly output topped 6-billion kwhr mark for the first time. Jan. 23, p 11

Transformer noise of 71 db successfully reduced to 52.5 db by four walls of sand-filled pumice blocks. Nov. 20, p 114

Percentage relaying reduced burden on line current transformers by reducing current in pilot-wire, also overcomes differences in current transformers. Dec. 18, p 96

Generation, large-scale and efficient, exemplified by new Philip Sporn plant; 9,206 Btu, 2,000 psi 1,050/1,000 F from six 150 Mw units. June 5, p 81

Electric water heating in commercial establishments is promoted to build summer load. Sept. 25, p 105

Radioactive tracers can check flyash collector efficiency, determine where the ash falls, locate manhole covers under snow and ice. Dec. 18, p 92

100 Significant Developments of 1950

Helicopter effective in stringing transmission circuits over terrain otherwise necessitating building of trails. Apr. 10, p 96

Profile mapping of 132-kv line by stereoscopic aerial photography halves engineering cost. Apr. 10, p 89

Arkansas Electric Cooperative Corp. Fayetteville, Ark., gets REA loan of $10,558,000 to build a 30,000-kw steam plant to be leased later to SPA. Dec. 11, p 6

Mississippi Co-ops and Mississippi P&L Co discovered a way to evade REA rules restricting power contracts to five years by resorting to a five-year renewal clause at lower rates. Dec. 11, p 11

Aggressive selling of electric water heaters, including close co-operation with local trade, proves they can be sold in quantity in low-price natural gas area. Nov. 6, p 128

Mercury cycle coordinated with steam to achieve 9,200-9,400 Btu per net kwhr economy. Mar. 27, p 99

Vulcanized joints in rubber covered cables can be made with pressure tapes, heater and no metallic mold. Feb. 27, p 80

Ratification of a treaty with Canada makes possible redevelopment of the Niagara River for electrical energy production. Both countries can now divert more water. Aug. 21, p 5

Secondary capacitors for pioneering system reduce losses and release capacity of both transformer and secondary circuit. Apr. 10, p 98

New inhibitor di-tert-butyl-para-cresol promises to lengthen greatly the service life of transformer oil. May 8, p 84; Sept. 4, p 29; Oct. 30, p 13

Distribution transformers will predominantly be supplied with inhibited oil; several manufacturers started the practice after mid 1950. Oct. 30, p 13

Two Oklahoma utilities and SPA ended six years of negotiation by agreeing on a contract for the sale and interchange of energy. July 24, p 6

Carrier relaying has high index of successful operations on 115-kv interconnection ties. Mar. 13, p 84

Mechanical rectifier, on 3,500-amp 280-v dc service for one year, shows better than 96% efficiency and saves space. Jan. 16, p 73

Electric house heating imposes a responsibility for service on utilities, who should take lead in its orderly development. May 8, p 81

Statistics of the electric utility industry show that by 1955 generating capacity in excess of 90 million kw and energy sales approaching 350 billion kwhr are to be anticipated. Jan. 30, p 101

HH-type conductor on Hoover Dam line has become more flexible with age and more susceptible to vibration and segmental breaks. Apr. 17, p 4

Meter test data can be analyzed en masse for trends by focus upon the arithmetical average and the standard deviation. Dec. 18, p 84

Purchase of properties of Puget Sound P&L Co by the City of Seattle won by a narrow margin, but the courts probably will have the final say. Nov. 27, p 14

Thirty-man electric utility defense advisory council was named by Interior Secretary Chapman. Investor-owned companies had 21 representatives. Oct. 23, p 82

Gas turbine on Maine utility system can be full started in four minutes for peak load operation. Oct. 23, p 94

Auxiliary power supply for major units in power plant has come into question on the ground of relative reliability of alternative schemes. Nov. 6, p 74

All-weather corona loss data on 500-kv test line leads to decision to adopt 300 to 315 kv for the first line to outstrip the 287 kv of the Hoover Dam line. July 3, p 76; Sept. 11, p 101; Sept. 25, p 76

RCA and Pilot Radio Corp filed suits to stop CBS color telecasts. Oct. 23, p 83 The CBS color system was approved over that of its competitors by FCC. Oct. 2, p 4

Central station service has reached 5,053,676 farms; 86.3% of those in the nation, REA reports. Oct. 23, p 83

Gas turbines peculiarly appropriate where fuel is cheap, water expensive, there are peak loads or stub-end generation to be reinforced. Aug. 14, p 88

Substation bus patterns can pay off in reduced investment cover maintenance and good performance if they are based on careful analysis of their predecessors. Sept. 5, p 94

EEI'S eighth annual power supply survey indicated that there is plenty of power and that at December's peak there will be a margin of 7.5 million kw or 11.7% Oct. 30, p 4

Electric utilities and manufacturers must operate under the Defense Production Act. Sept. 11, p 98

Cost of electricity in industrial production averages less than ½ of 1%. "Cheap power" is not a determinant in decisions on factory locations. Nov. 6, p 84

Distribution at 12 kv saves in substations and feeders relative to 4 kv, regardless of the load densities. Aug. 28, p 84

Submarine cable taper-tailored to varying ambients over 20,000-ft run saves over $22,000. Oct. 23, p 91

Mercury-arc street lighting comes out second best in comparison on equal performance basis with incandescent in terms of fixed and operating costs. Apr. 10, p 94

Defense Power Administration set up Dec. 4 with Interior Secretary Chapman as head. Industry man was to be picked as administrator. Dec. 11, p 6

System instability due to weak generator excitation because of extensive resort to capacitors has been an infrequent episode. Nov. 20, p 117

Radioactive carbon facilitates study of insulating oils by finger-printing sludge-forming propensity, adsorption, colloidization. Apr. 10, p 93

Hurricanes register their approach on a radar screen as warning of possible disruption of electric utility or industrial operations. Apr. 24, p 91

Power plant construction costs increased in 1949 but improved performance of the new capacity lowered the cost of producing a kwhr. Apr. 24, p 100

Pacific Power & Light stayed in the private power column as the result of the sale of its common stock to a syndicate which later resold to the public. Feb. 13, p 64

South Carolina Power Co, Charleston, was merged into South Carolina Gas & Electric Co, Columbia. May 8, p 72

Coal stockpiles are being inventoried by stereoscopic aerial photography with accuracy and dollar saving. Dec. 18, p 88

Gas-filled 15-kv cables chosen to give industrial plant warning of sheath breaks likely to cause expensive production outages. Feb. 13, p 73

Electric bake oven with capacity of 4,000 loaves of bread per hour is claimed to be the largest yet. July 17, p 26

Home laundry survey indicates how customers like the automatic washer and clothes dryer and how they are used. July 17, p 88

Floods hit the Pacific Gas & Electric System, knocked out eight hydro plants and cut all transmission facilities to five others. Result was 460,000 kw off the line. Dec. 4, p 89

Safety is a matter of finding effective remedies for the risk that employees will be careless in doing routine jobs. Oct. 9, p 89

Frequencies other than 60 cycles are still being used by 33 electric utilities and 3 other producers in 52 areas in 24 states. June 19, p 96

Chemical treatment practice for brush-killing on right-of-ways analyzed comparatively by 12 utilities. June 5, p 116

H-bomb site picked by AEC is in southern South Carolina. Project may generate its own power. If not SEPA probably will. Dec. 4, p 90

Total dust and ash fall around metropolitan area found to comprise only a 10% contribution from the utility power plants. May 22, p 138

How to sell Planned Lighting is told in the words of the man who wears out his shoe leather calling on prospective buyers. July 31, p 79

Dielectric ovens save eastern states farmers $1 million per year in sanitizing burlap feed bags for re-use. Aug. 14, p 120

Current transformers avoided by design of socket mounting device extending range of 50-amp self-contained meter to 200-amp capacity. Jan. 30, p 146

Thirty-ampere meter preferred by one utility on ground it better fits the prospective loads than the 15 or 50-amp ratings. Dec. 4, p 112

Horn-gap switch application is more dependable when separations are based on arc reach with and without wind. Dec. 18, p 79

Cooling water deficiency is increasing in some areas and is forcing resort to wells, cooling towers and spray ponds, in one instance to all three. Dec. 18, p 82

Electrical-mechanical boards in compact mimic-diagram design with miniature instruments gives intelligent control with minimum communication. July 17, p 98

Atomic power from nuclear piles may be a technical possibility in another decade in opinion of World Power conferees. July 31, p 73

Toledo Edison Co, last and richest of Cities Service Co's once extensive electric utility holdings, sold to Cities Service's stockholders. May 8, p 77

100 Significant Developments of 1950

Wind storms and floods swept Mid-Atlantic states and deprived three million customers of electric service. Hard hit utilities threw all their forces plus recruited staffs on the job; service restoration rapid. Dec. 4, p 88

Compact layout of semi-outdoor steam plant effects savings by shortening pipe and wiring runs and reducing number of valves. Nov. 6, p 88

Boiler headers, obscured by trend to unit boiler-turbine combinations, do contribute to enhanced availability and reduction in reserves. Jan. 2, p 58

"Electric Farming" in Michigan, including reclamation of swampland and refrigeration of fruits, brings average annual farm revenue up to $77. Aug. 28, p 88

Radiant glass heating saves floor space, facilitates production and improves safety in manufacture of product containing petroleum mixture. Sept. 11, p 154

Pumped-storage hydro (second in USA) provides peaking power from water raised by means of off-peak steam capacity. Sept. 25, p 87

Electric Bond & Share Co, largest electric utility holding company registered under the Holding Company Act of 1935, disposes of all holdings and asks for exemption from the act. Sept. 11, p 104

Selling replaces demand as spur to capacity increase as Pennsylvania Power & Light Co launches "3-phase" sales program. Apr. 24, p 97

Sales departments of power companies are under-manned. Secure in anonymity, 81 sales heads speak without reserve of the problems that face them. Mar. 27, p 83

Aerial cable secondary network postpones underground, improves appearance and adds to system capacity in secondary business district; 600-v, aluminum-spinner-installed. Aug. 14, p 76

First big aluminum plant using electricity generated by natural gas instead of water was opened by Alcoa at Point Comfort, Texas. July 3, p 66

Virginia Electric & Power Co for the second time was recommended by an FPC examiner as the party to develop the Roanoke Rapids hydro project. Nov. 27, p 13, But Interior Dept is still fighting. Dec. 11, p 13

Ohio Public Service Co was merged into the Ohio Edison Co system. March 20, p 4

Alaska is to get its first big hydro project—30,000 kw at Lake Eklutna, near Anchorage. Bureau of Reclamation will build the project. Aug. 28, p 62

Fluorescent street lighting shows promise, but has not reached economic practicality. Expense will confine first applications to special requirements. Mar. 13, p 79

Condenser throat steadily becoming a favorite place to locate bleed heaters; it saves space, conserves heat and reduces moisture in turbine steam. July 31, p 102

Snowfall and runoff increased up to 12% on West Coast by seeding of clouds from airoplane. Mar. 13, p 70

Subtransmission at 69 kv in metropolitan area saves 30% over-all, reduces number of feeders 80% and cuts building outlay 85%. July 17, p 83

Partial generator output obtainable by reconnection of undamaged windings for reduced-voltage operation while awaiting replacement coils. July 31, p 98

Marine-type boilers under pressurized operation to give 12-Mw plant a heat rate of 14,400 and a unit cost of $145. Oct. 23, p 98

Residential load building activities of electric utilities lagging behind increases of population and income. Feb. 13, p 91

Munitions explosion damages East coast power plant; resumption of service delayed by search for unexploded mines. May 29, p 13

Diversion channels are kept clear of fish by luring them away by means of moving lights. Apr. 10, p 112

River topography study reduced in cost by aerial photography. Apr. 24, p 111

Lightning protection acquires a new arrester with low IR discharge voltage, low impulse sparkover voltage, simplicity of design and narrowed tolerances. July 17, p 103

Service restoration is facilitated when subtransmission is sectionalized by means of automatic pole-top switches with coordinated manual or reclosure operation. Sept. 11, p 124

Rural distribution at 14.4/25 kv in rugged, sparsely settled areas costs only 1/3 as much as a 7.2/12.5 kv system for same loading. Oct. 23, p 102

Mobile Power Units Fulfill System Need

Mobile generating units have found their place in the operation of three middle-western utility systems. These units have been operated at numerous locations: (1) To maintain service while transmission lines were being rebuilt or relocated or while substation transformers were being replaced; (2) to maintain service under emergency conditions; (3) to relieve power shortages. One unit was delivered in 1946 to Northern States Power Co, one to Wisconsin Michigan Power Co in 1948 and another to Wisconsin Power and Light Co in 1949.

MOBILE DIESEL generator unit that supplied power for two months to Northern States Power Co system at Mayville, N. Dak., during transmission line reconstruction

Railway Unit . . . . On Nov. 18, 1946 a diesel generator mounted on a railway car was delivered to Northern States Power Co at Riverside Steam Plant in Minneapolis. This unit has a 1,080-hp, 600-rpm, 8-cylinder engine, with an air starter at 250 lb and a supercharger. Generator is a 960-kva, 2,400/4,160-v unit. Railroad car is 53.5 ft long and about 10 ft wide. Total weight of complete unit is 211,000 lb and approximate cost was $100,000.

After satisfactory tests, unit was shipped to Mayville, N. D. where it carried local load of Mayville, Portland and Hatton during rebuilding of a transmission line. The unit provided power from Dec. 9, 1946 to Feb. 19, 1947. It was then shipped to Hatton, N. D. where it ran from Feb. 20 to March 9, 1947 during conversion of a line to 69 kv.

Operating costs covering other movements through the Dakotas, Wisconsin and Minnesota totaled $7,480. Table I lists power generated by this unit from Dec. 1946 to May 1950.

TABLE I—Energy Supplied By Northern States Power Co Railway Unit 1,080 hp, 960 kva, 2,400/4,160 v

	Kwhr Generated				
	1946	1947	1948	1949	1950
January	.....	214,630	41,900	7,300	.....
February	.....	160,990	39,000	.....	100
March	.....	80,980	20,800	300	4,900
April	.....	40,160	32,700	300	300
May	.....	5,010	3,200	700	23,700
June	.....	5,480	8,800	44,300	.....
July	.....	.....	2,600	59,800	.....
August	.....	37,100	34,900	35,800	.....
September	.....	105,300	47,600	56,900	.....
October	.....	130,800	100	20,000	.....
November	.....	28,600	74,000	16,200	.....
December	145,340	41,400	68,000	3,500	.....
Year's Total	145,340	850,450	373,600	244,400	29,000
TOTAL	.....	.....	.....	.....	1,642,790

TABLE II—Energy Supplied by Wisconsin Michigan Power Co Trailer Unit 650 hp, 500 kva, 2,400 v

Date, 1949	Kwhr Generated	Reason
May 4–20	15,900	Reroute trans line
June 21	3,000	Repl sub sta transf
June 23	1,000	Repl sub sta transf
July 29	1,000	Emergency–severe electrical storm
Total	20,900	

TABLE III—Energy Supplied by Wisconsin Power & Light Co Trailer Unit 250 hp, 200 kva, 2,400 v

Month, 1949	Kwhr Generated
April	3,000
May	7,700
June	4,700
July	2,800
Total	18,200

Trailer Unit . . . . Wisconsin-Michigan Power Co received a 650-hp, 500-kva, 2,400-v diesel generating unit in Nov. 1948, at Iron Mountain, Mich. It is powered by a 1,200-rpm, 8-cylinder engine with a 32-v battery for starting and a supercharger. This unit is mounted on a trailer which is 27.5 ft long and 8 ft wide. Front tires are 4 900x20; rear tires 4 1,000x15. Total weight of the complete unit is 40,000 lb and approximate cost was $50,000.

When first received this unit was operated at Iron River, Mich., for peaking service during the power shortage of late 1948 and early 1949. Since that time it has been operated in Michigan and Wisconsin. Table II lists power generated by this unit in 1949—a total of 20,900 kwhr.

Another Trailer Unit . . . . On Feb. 1, 1949, Wisconsin Power and Light Co acquired a 250-hp, 200-kva, 2,400-v diesel generating unit. Engine is 1,600-rpm, 6-cylinder model with a 12-v starter and no supercharger. This unit is mounted on a trailer 20 ft long and 7.66 ft wide. Front and rear tires are 8.25x15. Total weight of the complete unit is 36,000 lb and approximate cost was $21,000. Table III lists power generated by this diesel generating unit during the year 1949.

[1] Based on a report presented to Wisconsin Utilities Association.

Before . . .

Pendant luminaires with 6,000-lm lamps, spaced about 300 ft apart, provided less than 0.2 ft-c average on pavement

After . . .

Closer-spaced, low-brightness fluorescent units put over 1 ft-c on the pavement with a more uniform distribution

Detroit Tries Fluorescent Street Lights

Installation on half mile of major traffic artery provides opportunity for appraisal of benefits in relation to costs in full-scale test

LOUIS J. SCHRENK, Superintendent
Public Lighting Commission, Detroit, Mich.

In order to evaluate fluorescent street lighting, the Detroit Public Lighting Commission recently installed fluorescent fixtures along a half-mile stretch of a major traffic artery. Experience with this pioneer system will make it possible to appraise the comfort and visibility benefits per dollar of cost to be obtained from this type of lighting. Actual comparison of the fluorescent benefit-per-dollar ratio with the benefits and cost of filament and mercury luminaires will provide a concrete answer on which the future of fluorescent roadway lighting will depend. And, moreover, such data will contribute substantially to the sum total of street-lighting knowledge.

The Detroit fluorescent installation is an outstanding and spectacular example of good roadway lighting. The newly installed system covers six blocks of Wyoming Avenue, an asphalt road 46 ft wide which carries a heavy volume of north-south traffic through one of Detroit's outlying business districts. In the system are 24 V-shaped fixtures, each equipped with four T-12 fluorescent lamps, 96 in. long and 1½ in. in diameter.

Light Output. . . Each of the fixtures consists of two separate aluminum reflector units, 8 ft long, joined together at a lateral angle of 30 deg. Each reflector contains two lamps, light from which is directed to the roadway through a weather-resistant plastic window. Together, the four lamps in each fixture produce 19,000 lm (initial). The fixtures are on a straight series circuit, and each lamp now operates at 430 ma. Additional light output can be easily obtained by increasing the current input to the lamp. Simply by adjusting the constant-current regulator, the lamps can be operated up to 600 ma without an appreciable loss of life, thus increasing the lumen output from 19,000 to 24,000. Ballasts for the luminaires are housed in weatherproof, pole-mounted boxes.

The luminaires are mounted 25 ft above the pavement on existing wooden poles spaced about 140 ft apart between, and 100 ft apart at, intersections. Light-meter tests conducted since the installation was turned on November 3 confirm the average calculated illumination level of more than 1.0 ft-c. This is perfectly adequate for heavy pedestrian and vehicular traffic, and about 20% higher than that required for medium-traffic arteries by American Standard Practices for Street and Highway Lighting. The new fixtures replaced eight, old-type pendant luminaires, each of which contained a 6,000-lm filament lamp. Spaced at wider intervals and mounted at about the same height, the old fixtures provided an average illumination level of less than 0.2 ft-c.

Practically Glareless . . . Actually, the fluorescents produce nine times the lumen output and provide 27 times better visibility than the old lighting system. The old system was installed about 1925, when this section of Wyoming Avenue was still a country road. Fluorescent luminaires were selected to bring up the level of lighting and visibility to present-day needs because they produce the required lumens with

V-Shape Units . . .

Author poses with an 8-ft fixture. Each side of the V contains two enclosed lamps

General Electric Co photos

By Day . . .

Mounted on brackets extending them over the pavement, the fluorescent luminaires are quite conspicuous in the daytime—much more so than those which they replace

somewhat less than one-half the energy consumption of present-day filament fixtures. Moreover, fluorescent luminaires throw a bright, yet virtually glareless light on the pavement which makes possible easy and quick seeing by motorists and pedestrians alike. The expected result of this "more comfortable" seeing is, of course, greater safety.

It is readily apparent to anyone inspecting Detroit's Wyoming Avenue installation that fluorescents accomplish all the major street-lighting objectives: comfortable seeing, good visibility, pavement brightness, obstacle brightness, minimum veiling glare, and a new low in "discomfort glare," such that the luminaires are hardly noticeable in the field of view. These are basic, fundamental requirements that should be applied to any type of system, whether filament or mercury. But what about the extra benefits provided by fluorescents? Fluorescents have low luminaire brightness, an extremely important consideration; provide wider areas of pavement brightness; and are spectacular in appearance.

Many of these advantages are inherent in the design of the fixtures themselves. Laterally, the light distribution from an eight-foot reflector is broad. Vertical control of the distribution concentrates as much light as possible at angles necessary for uniformity of pavement brightness; at higher angles the light diminishes rapidly. The result, of course, is less glare. The eight-foot long fluorescent fixture is about five times as large in area as the equivalent filament-lamp fixture.

Reflections on Wet Pavement . . . Wet-weather conditions accentuate the improved seeing made possible by fluorescent street lighting. One of the reasons for this, of course, is the eight-foot length of the fluorescent light sources extending out over the roadway. Wet pavement reflects images of the street lights to the drivers' eyes. Objects on the road are most easily seen in silhouette against the brightness of these light streaks extending along the pavement, in line with each luminaire. Because the width of these pavement streaks depends on the size and location of the light sources, those caused by the fluorescents along Wyoming Avenue are wider and provide more complete coverage of the roadway.

Even when dry, Wyoming's pavement surface has a sheen which directly reflects each fluorescent light source mounted over the roadway. These brightest areas of the pavement surface are much wider under the larger fluorescent luminaires; the pavement is more uniformly bright, and there are fewer shadows than with conventional fixtures.

Keeping pace with increased traffic, both vehicular and pedestrian, requires continual experimentation with new light sources. By modernizing the street-lighting system alone, the number of night fatal accidents has been reduced by more than 50% in all sections of Detroit, and on many heavy-traffic arteries the ratio of night-to-day fatalities has been reduced from 7 to 1 to 1.5 to 1. Detroit, with its 44,000 fixtures, has during the past half-century been a proving ground for several new types of lighting units utilizing optical system for improved visibility.

Benefits and Costs . . . With Detroit's pioneer fluorescent system, first of its kind in this country, it will be possible, in the not-too-distant future, to analyze it completely from a benefits-cost point of view. Studies already made indicate that fluorescent luminaires provide a degree of comfort and ease of viewing never before approached in effective street-lighting practice. Whether this system will be expanded to other parts of Detroit depends on the results of further analysis. However, it is expected that operational and maintenance costs will be considerably less than for conventional fixtures of equivalent light output. Initial costs, on the other hand, are somewhat higher. From experience with the Wyoming Avenue installation, it will be possible to determine accurately whether higher initial cost is off-set by lower maintenance. On the side of extra benefits afforded by fluorescents—such as uniformity of illumination; greater visibility, particularly on wet pavements; less glare; and spectacular appearance—they already appear to be better than conventional fixtures in virtually every respect.

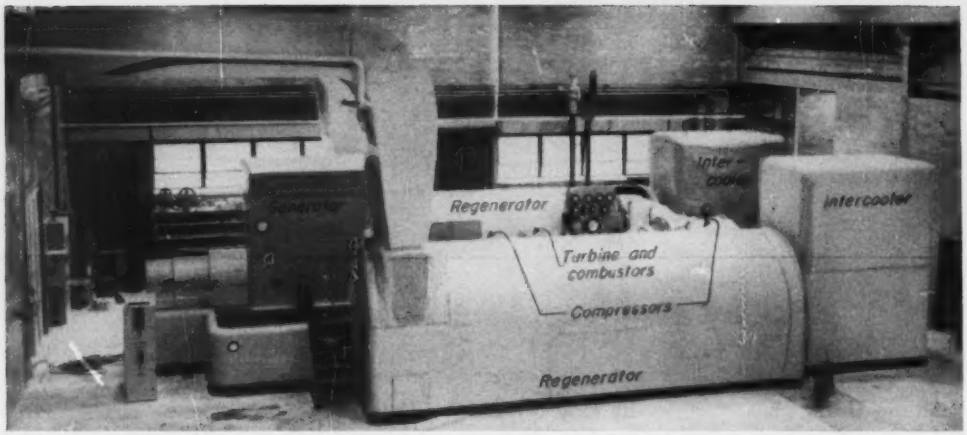


FIG 1—REGENERATIVE GAS TURBINE of 5,000-kw rating in compact arrangement has intercoolers and regenerators on one level. Turbine, compressors and combustors are between twin regenerators. Estimated cost is under $200 per kw

Regenerative Gas Turbine Efficiently Supplements Hydro

Bangor utility selects first of regenerative type gas turbines for its new Edward M. Graham station to provide standby and peak back-up for hydro in conjunction with diesel capacity

PAUL F. KRUSE, Chief Engineer
Bangor Hydro-Electric Co, Bangor, Maine

The Bangor Hydro-Electric Co has recently completed the installation of the first regenerative type of gas turbine unit to go into central station service in this country. Operation of the unit was begun on Oct. 30, 1950.

Increased over-all efficiency is expected from the installation in comparison with non-regenerative equipment. This is due to utilization of a substantial part of the residual heat in the turbine exhaust to preheat the compressed air before it enters the combustion chambers. The initial unit (Fig 1) is rated at 5,000 kw by the manufacturer, but the expected maximum output at 70 F is 6,000 kw.

The machine was ordered in October, 1948. A new brick and steel structure (Fig 2) will house this first unit and provide space for a second of like design. The new plant comprises the Edward M. Graham generating station, oil storage tank, cooling water intake, substation and interconnecting transmission facilities.

All-Hydro Generation Inadequate . . . Decision to purchase the gas turbine culminated a long series of studies by the company's engineering staff.

The company serves east central Maine, reaching about 100 communities having an estimated population of about 145,000.

Before December 1948, all system generation was hydroelectric. There are 11 hydro plants aggregating 39,570 kw effective capacity under normal water conditions. In 1948 three 2,000-kw diesel plants were installed. With the new gas turbine at Veazie the capacity of the thermal units will reach 12,000 kw, bringing total generating capacity to 51,570 kw. Individual hydro plants range in capacity from 320 to 9,300 kw. Normal heads range from 17 to 60 ft. Ten of the hydros are of the run-of-river type, operating under heads of 14 to 25 ft.

Many of the company's plants have the benefit of controlled storage on the principal branches of the Penobscot River totaling about 61.5 billion cu ft. Additional storage of about 6 billion cu ft is available elsewhere.

Studies by the Bangor company initiated as far back as 1937 weighed the relative economy of a steam turbine generating plant and further hydro development. Considering the power and process steam requirements of a paper mill customer it appeared that customer installation of a new boiler plant and high-pressure steam turbine installation would provide lower cost energy than any other type of plant then investigated, including undeveloped water power sites. It was

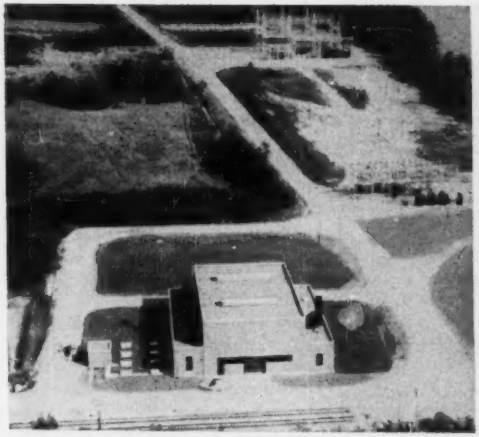


FIG 2—SIMPLE BUILDING of brick and steel adjacent to substations houses gas turbine with space for second unit

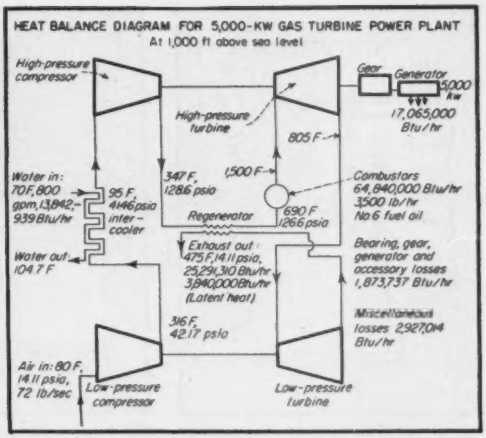

HEAT BALANCE DIAGRAM FOR 5,000-KW GAS TURBINE POWER PLANT
At 1,000 ft above sea level
High-pressure compressor
High-pressure turbine
Gear
Generator 5,000 kw
17,065,000 Btu/hr
805 F
Water in: 70 F, 800 gpm, 13,842,939 Btu/hr
95 F, 44.6 psia
inter-cooler
347 F, 128.6 psia
1,500 F
Combustors 64,840,000 Btu/hr 3500 lb/hr No 6 fuel oil
Regenerator
690 F 126.6 psia
Water out 104.7 F
Exhaust out 475 F, 14.11 psia, 25,291,310 Btu/hr 3,840,000 Btu/hr (Latent heat)
Bearing, gear, generator and accessory losses 1,873,737 Btu/hr
316 F, 42.17 psia
Miscellaneous losses 2,927,014 Btu/hr
Air in: 80 F, 14.11 psia, 72 lb/sec
Low-pressure compressor
Low-pressure turbine

FIG 3—HEAT BALANCE diagram shows 17,065,000 Btu per hour output from 64,840,000 input in content of No. 6 fuel oil

also determined that the development of further increments of capacity at the company's existing run of river plants at Veazie and Milford, together with increased capacity at the Ellsworth hydro station could be done at comparably low cost. This held new capital investment to a minimum. Operating costs at the existing plants were not materially increased by the new capacity. This policy was adopted, and between 1938 and 1943 8,500 kw in hydro units were installed. When the new steam plant of the paper company went into service (see Fig 4) in the fall of 1947, its effect was to release about 10,000 kw of the utility's generating capacity for supplying the demands of other types of load and for meeting postwar growth. In so far as area power requirements are concerned this was the equivalent of a 10,000-kw addition by the power company itself.

Diesel Units Bought . . . Immediately following World War II the Bangor company experienced the same accelerated growth of domestic and other firm types of load as did other parts of the country. Coincident with this rapid rate of growth there began in July 1947 and extending to November 1949 a drought unequalled in any similar recorded period. It was clearly apparent that to guarantee continuous service to this firm type of load, thermal capacity was required on the system to back up the com-

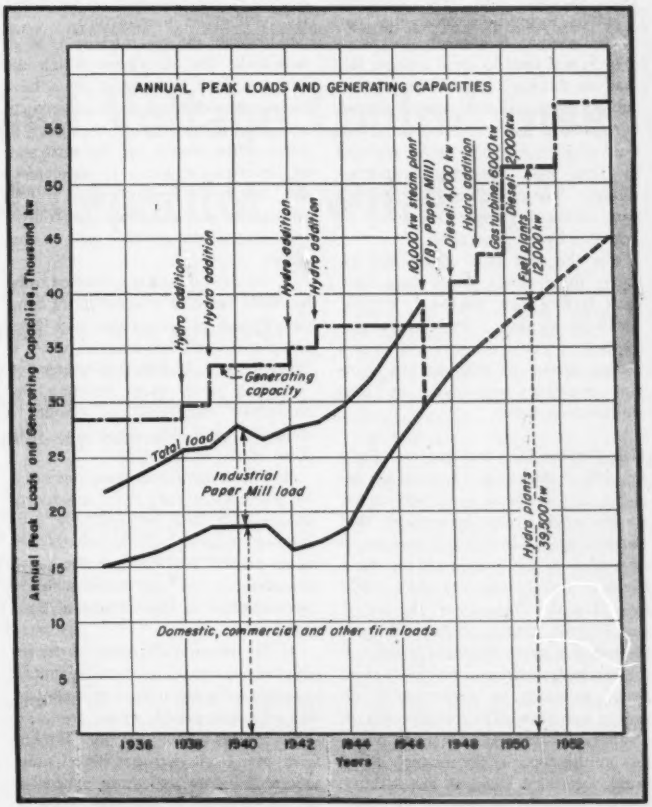


FIG 4—TOTAL LOAD encroached on generating capacity until 10,000 kw was recovered for postwar growth when paper mill installed its own plant

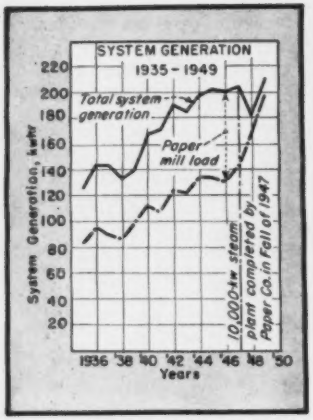


FIG 5—SYSTEM GENERATION PLOT discloses significance of paper mill load that was relinquished in 1947

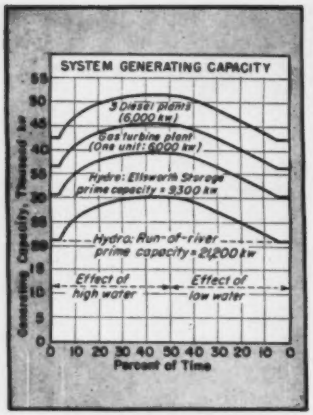

SYSTEM GENERATING CAPACITY
3 Diesel plants (6,000 kw)
Gas turbine plant (One unit: 5000 kw)
Hydro: Ellsworth Storage prime capacity = 9300 kw
Hydro: Run-of-river prime capacity = 21,200 kw
Effect of high water
Effect of low water
Generating Capacity, Thousand kw
Percent of Time

FIG 6—HYDRO AVAILABILITY under both high and low water indicates value of gas turbine and diesel increments

pany's hydros. The character of a part of the load was changing. Whereas formerly a substantial part of the company's generating capacity (Fig 5) was used to serve a paper mill load on the basis of secondary power subject to curtailment under adverse conditions if and when necessary, that type of load was now to be replaced by firm load requiring continuous service. The result was that the company could no longer rely solely on available hydro generation.

For the first step of thermal capacity three diesel plants were built, each having two 1,000-kw, 4-cycle, 1,425-hp engines. These were particularly useful in two locations in protecting service to fish packing plants and improving regulation on long transmission lines.

Gas Turbine Unit Selected . . . Early in 1948 President E. M. Graham decided, as a result of continued studies by the engineering department, that the next unit of generating capacity to be added to the system should be a thermal unit of not less than 5,000 kw. The development of the art of gas turbine manufacture had progressed to a point where the builder of the machine could guarantee equal or better economy in performance of such a unit than with a steam unit of comparable size. Tests were in progress at the time in the factory on a simple or single stage of gas turbine which indicated success in its performance beyond any reasonable doubt. Designs for the regenerative type of unit (Fig 3) had also progressed to the point where it was ready for commercial manufacture.

Although the gas turbine type of unit lacks the experience which the steam turbine and diesel types have had, it was deemed more advantageous than either steam or diesel in every other respect for the next step of generating capacity to supplement the company's hydro system. This conclusion was based on the following advantages of the gas turbine plant:

1. Its capital cost is estimated to be less than that of a steam plant of comparable size in this locality and when completed, with two units installed, is expected to be less than $200 per kw.

2. The power plant building and permanent structures are simple in character and less expensive than those of the steam plant.

3. The water requirement for cooling purposes is only from one-fourth to one-sixth that required for condensing purposes in a comparable steam plant. This factor was a major consideration in the location of a thermal plant in the vicinity of Bangor.

4. The thermal efficiency of the regenerative type of gas turbine unit is expected to be equal to or greater than that of a comparable steam unit.

5. The gas turbine will burn Bunker C or No. 6 oil, whereas diesel units require a lighter and more expensive oil. At present writing, the price of Bunker C oil is about two-thirds that of premium diesel fuel in Bangor.

6. The gas turbine unit may be placed on the line from cold conditions upon 30 minutes' notice. It does not require burning of fuel when out of service, as is the case of a steam plant where fires are banked and fuel is wasted in order to maintain the unit in a condition to be placed on the line in a reasonable time. This factor is of considerable importance to the Bangor company, since it is expected that the gas turbine plant will operate at a light load-factor on the peak of the load.

7. The gas turbine plant does not require highly specialized operating personnel and the number of attendants is expected to be less than would be required in a steam plant. This advantage should reflect substantial economy in operating costs.

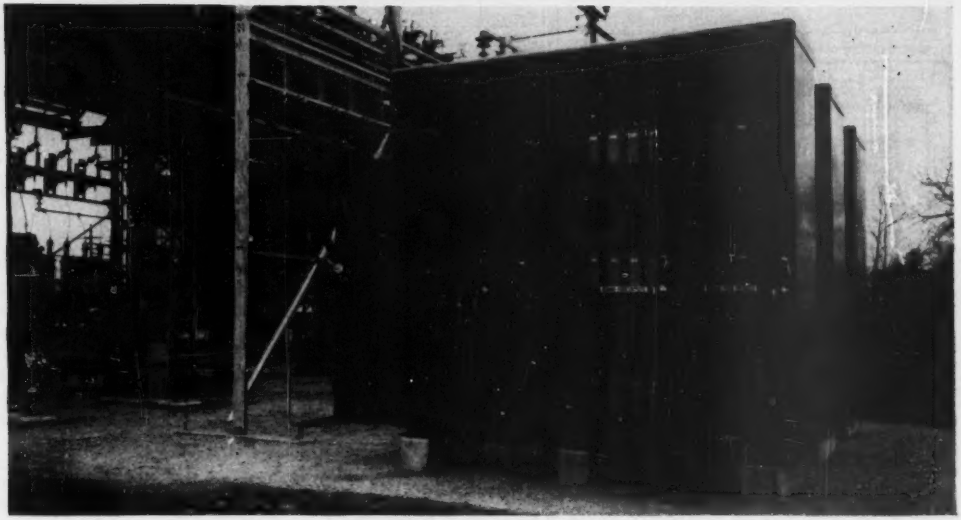
8. The maintenance charges on the gas turbine installation are expected to be no greater and possibly may be less than those of either steam or diesel units of comparable capacity. This is due to the comparative simplicity and relatively small number of component elements of the gas turbine.

The accompanying chart (Fig 6) indicates the manner in which the thermal plants are expected to be operated to supplement the company's system of hydro plants.

Fig 6 shows the prime capacity of the so-called run-of-river plants on the system to be about 21,200 kw. With the Ellsworth storage plant the system has a prime hydro capacity of 30,500 kw. The capacity of the run-of-river plants is affected not only by low water but also by reduced head in time of high water. Thus, with hydro operating conditions represented as existing 50% of the time, flow in the Penobscot River at Veazie is about 9,000 cfs and the operating head 17 ft. Under that condition the only limitation on output is the installed generating capacity of the plant.

For the low-water-supply operating condition (Fig 6) wherein the flow at Veazie is 4,700 cfs for approximately 5% of the time, the plant output is reduced because of insufficient water to supply all the installed capacity. In high water periods usually occurring in the spring, the plant output is curtailed by a reduction in head caused by lowering the flashboards on the dams and raising of tailwater

(*Continued on page* 108)



CAPACITOR EQUIPMENT, rated 2,700 kvar, 3-phase, 7.2/12.4 kv, with three-step automatic switching, is completely housed and self-contained. Compartment at left houses the oil switch, operating transformer, rectifier and control panel

Oil Switch and Voltage Control Give Low-Cost Capacitor Switching

Development of an oil switch for capacitor banks saved Pennsylvania Power & Light Co 9% on its half-million dollar expenditure for capacitor equipment. How this device pr[illegible]ible three-step switching of three-phase capacitors by automatic voltage control is told here

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When Pennsylvania Power & Light Co decided to install automatic-switched capacitors on its lines, a low-cost switching device was needed to provide an economical installation. Cost of such a device had to be as low as was consistent with good service. Previously, standard circuit breakers met the "good service" requirements but failed to meet the additional requirement of low cost. Subsequent development of a new low-cost switching device has saved 9% of the company's half million dollar initial investment in switched capacitors.

This is the second of two articles covering the use of switched capacitors on Pennsylvania Power & Light Co's system. The first article (December 4, 1948, page 85) described the economical use of capacitors for voltage control.

Design Factors . . . Several factors influenced the final design of the switching device:

1. The device had to be a three-pole, single-throw switch, adapted to switching three-phase capacitor banks.

2. Field tests on oil circuit breakers of adequate rating, employing arc interrupting devices, demonstrated the need for a switch having free oil flow to "wash out" the arc when switching capacitors. Moreover, tests showed that the conventional oil circuit breaker without the interrupting device, but with "open-type" contacts in oil with interphase barriers, would adequately switch parallel banks of capacitors without restriking of the arc. This was important because restriking on frequent switching would result in excessive maintenance of the switch.

3. The dual use of the device for both switching and fault clearing was

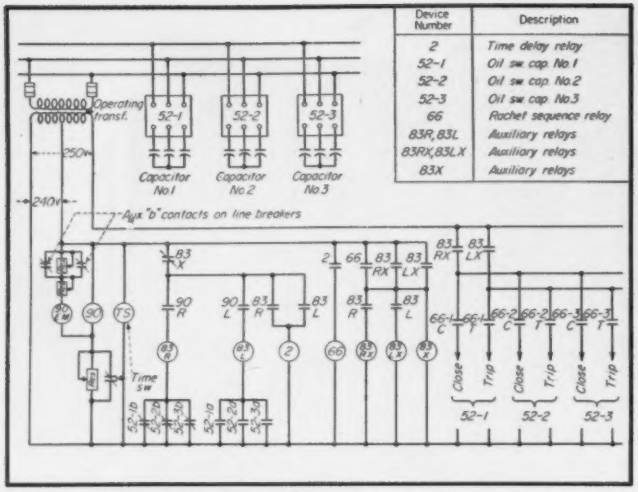


FIG 1—THREE-STEP VOLTAGE CONTROL includes a two-band-width voltage relay, means for recalibration of the voltage level setting to match major loading on the system, and provision for equalizing the switch and capacitor duty

next considered. It was shown that adequate protection could be provided with back-up fuses. With the fault clearing provision thus eliminated, development of a low-priced switching device was possible.

4. Determination of adequate thermal and electromagnetic characteristics was another factor. A review of over-all system usage indicated that if the device were capable of withstanding 20,000 amp momentarily and 10,000 amp for 5 sec, the switching device would perform satisfactorily on most installations. Before this switch was developed, the smallest and least expensive device suitable was a 600-amp, 3-pole, 15-kv circuit breaker having a short circuit interrupting capacity of 150,000 kva.

Testing the Switch . . . A switching device that met these requirements was designed and tested to prove its ability to switch 900-kvar, 3-phase, 12.47 or 13.8-kv capacitors in parallel with an energized capacitor ranging in steps from 0 to 4,500 kvar, with minimum impedance between banks. The switch, with 200-amp fuses in series, was closed and latched against a three-phase fault on a circuit previously calibrated for a maximum rms, asymmetrical, fault current of 20,000 amp. The fault was cleared by the fuses with less than one cycle of arcing without damage to the switch.

The device was connected to switch a 900-kvar, ungrounded, star-connected bank of capacitors on a 13.2-kv line. In this test, a back-up breaker energized the line about 8 cycles before the switch closed and de-energized it about 8 cycles after the switch opened. The device switched the capacitor bank on and off 17 times.

With the switching device connected as above and an 1,800-kvar capacitor bank connected permanently to the line, the device switched the 900-kvar capacitor bank on and off 10 times. After these tests the switch contacts were inspected and found to be in satisfactory condition and suitable for additional operation.

General Description . . . The switching device is an oil switch rated 200 amp, 15 kv, solenoid-operated from a 230-v rectifier and with 230-v shunt trip. Control voltage for operating the switching device and the auxiliary devices is furnished by a 3-kva, single-phase, 12,000—250/240/120-v operating transformer.

A completely housed, self-contained, 2,700-kvar, 3-phase, 7.2/12.4-kv capacitor bank with three-step automatic switching is illustrated. The compartment next to the capacitor houses the oil switch, operating transformers, rectifier, switch control panel and terminal blocks for terminating control connection between units. The three-step, voltage control panel for the three units is mounted in the front compartment of the center housing.

Sixty 15-kvar, single-phase, 7.2-kv single-bushing capacitor units in each 900-kvar housing are connected wye with the neutral isolated. Each capacitor unit is protected with an 8-kv, boric-acid capacitor target fuse to disconnect the capacitor in the remote event of a failure. Three discharge potential transformers in the housing, and connected between each capacitor bus and neutral, will reduce the voltage to 50 v within 1 min after the capacitors are switched off. A manually operated switch for grounding the three phases and neutral is key interlocked with the oil switch and capacitor compartment doors.

Voltage Control . . . When switched capacitors are located on a remote bus and are fed by two parallel lines having approximately the same conductor sizes, spacing, and circuit length, the voltage rise produced by a given size capacitor will double if the source reactance is doubled. An example of this is when a line breaker opens to leave the bus and capacitor fed by only one line. To overcome pumping due to voltage change being greater than band width in such a situation, voltage control was furnished with band width settings which could be increased automatically when either line breaker opens.

The automatic control (Fig 1) receives and interprets the signal and acts to perform the switching functions. This control acts in response to voltage change and requires four general basic items of apparatus: (1) The voltage regulating relay, (2) time delay devices, (3) sequencing device, and (4) miscellaneous auxiliary relays and devices.

The voltage relay with double band width adjustments is shown in Fig 2. Two rheostats are connected in series with the electromagnetic coil for adjusting band width, one rheostat giving the large band spread setting and the two in series giving the small band spread setting. The auxiliary "b" contact on the line breaker may be used to by-pass one of the rheostats to increase the band width setting when the line breaker opens. A seven-day dial time switch is included to add or remove one of the rheostats in series with the main coil of the voltage relay

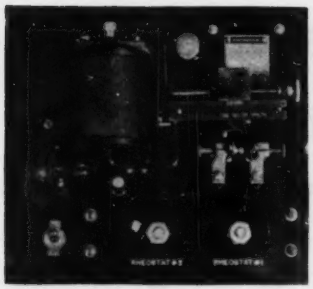


FIG 2—VOLTAGE RELAY with double band width has two rheostats that connect singly or in series with electromagnet coil for large or small band spread

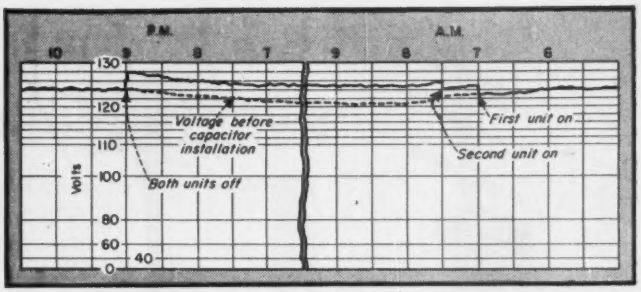


FIG 3—VOLTAGE SUPPORT to match major loading on the system is provided by a two-step capacitor installation. Note the effect on the voltage of the recalibration control, which causes both capacitor units to be switched off at 9 pm by lowering the upper limit of the contact-making voltmeter from 128 v down to 124 v

to change its calibration to roughly match major loading on the system.

The measurement of the duration of the voltage dips and peaks is accomplished by single time delay with a very fast reset feature. The selection of a closing or a tripping operation is performed by two auxiliary relays with momentary delay on opening, supplemented by two multi-contact auxiliary relays. Both sets of relays (closing and tripping) are connected in such a manner that a closing operation will not be attempted when all breakers are closed and a tripping operation will not be attempted when all breakers are open.

The sequence in which the capacitor switches open and close is selected by a solenoid-operated, ratchet-type, stepping relay. In this relay, cams, which operate six switches in pairs in a definite sequence, always move in the same direction for both closing and tripping operations, giving continuous sequence with no fixed starting point. Over a period of time the number of switching operations, and the hours in service for each capacitor switch, will be approximately the same.

Control Adjustments . . . Successful operation and satisfactory performance of automatically switched capacitors depends on the proper adjustment of the control mechanism, with respect to voltage band width, and upper and lower limits of the contact-making voltmeter (cmvm), including recalibration and time switch settings.

A record of voltage taken at the prospective capacitor installation, usually from a Friday to Tuesday, inclusive, is carefully reviewed to determine when capacitors are needed for voltage support. Calculations are made to determine the estimated voltage rise for each capacitor step (900 kvar on 12 kv) or for the maximum step permissible to limit the voltage rise to approximately 5%. Because 2,700-kva units go "on" and "off" in three 900-kvar steps, control settings are always based on one step or bank of capacitors.

On the PP&L system the entire system voltage level is raised or lowered in accordance with load. At some locations voltage during maximum load may be as high or even higher than minimum load; at other locations voltage level may be almost a flat curve day after day. Under such conditions capacitors will not switch themselves off during minimum load, or if they should, will not return to service during maximum load. This condition is taken care of by automatic recalibration of the voltage control by the time switch. However, should the voltage drop to an abnormally low level, 5 to 7 v below average, the capacitor will come on automatically to support the voltage. Obviously, such unusual conditions could not possibly be handled by the use of direct time switch control alone.

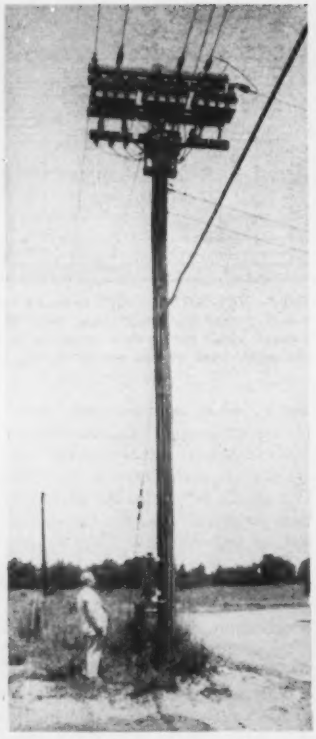
Typical Adjustments . . . As an exaple of how adjustments are made, these voltage readings were first taken on a 12-kv line with a 100 to 1 potential transformer:

Load	Voltage Level, Volts	Remarks
Minimum	124	1 am to 6 am
Maximum	121	Monday to Friday inclusive
Weekend	125	Saturday and Sunday

It was desired to install an 1,800-kvar bank in two 900-kvar steps. Calculations indicated that each step would increase voltage level by 2 v. Because experience has proved that the band width of the cmvm must be at least 2 v greater than the actual capacitor voltage rise to prevent pumping, band width on the cmvm was set at 4 v.

The next step was determination of upper and lower voltage limits for the cmvm during maximum load periods. To insure both units going into service during heavy load periods, lower limit setting should be about 2 v higher than the resultant maximum load voltage (123 v) with one unit in service. In this example therefore, the lower limit setting was 125 v and, using a minimum band width of 4 v, the upper limit became 129 v.

The foregoing limits insured both capacitor banks coming into service during maximum load periods. However, because minimum load voltage with both banks on the line is 128 v, or 1 v below the upper limit of the cmvm, the banks will not come off the line automatically with only cmvm control. To remove both banks, use is made of "recalibration" control, a variable resistor in series with the voltage coil of the cmvm. The time switch shunts this resistor and in so doing raises the voltage on the cmvm coil which lowers the voltage level setting. The band width is practically unaffected but the voltage level within which the control operates is directly determined by the amount of resistance in the cmvm voltage coil circuit. The time switch is set to "open" its contacts in the morning, usually 7 am, inserting the resistor in the cmvm



POLE-MOUNTED, automatically switched capacitor banks are also used on this company's lines—factory assembled, metal enclosed 3-phase, 4 kv, 180 kva (left); 3-phase, 4 kv, 180 kva (center), and single-phase, 7.2 kv, 90 kva (right), both field assembled, open type. Control box is pole-mounted near the ground. Contemplated for use on three-phase rural lines are open-type 12-kv banks, consisting of single-phase, 150-kva units on three adjacent poles with control box on center pole

circuit, and to close its contacts to by-pass the resistor at the end of the load period.

In the example being discussed, voltage during minimum load without capacitors (see accompanying table) is 124 v and with both capacitor banks in service, 128 v. Therefore, to remove both banks from service, the upper limit of the cmvm should be 124 v, (the lower limit should be 120 v) when the calibrating resistor is bypassed. These are the settings for minimum load periods, or "night-time" operation. If it is desired to omit normal operation of the capacitors on Saturdays and Sundays, the time switch action can be set accordingly.

Sections of a recording voltmeter chart (Fig 3) illustrate the action of the calibrating resistor and time switch. This capacitor installation gives about 4-v support during maximum load. The effect of the "recalibration" control is evident at 9 pm when the cmvm is recalibrated with 124 v as the upper limit, thus causing both banks to switch "off."

Maintenance . . . After initial adjustments, the capacitor is placed in service and a portable recording voltmeter installed to determine whether operation is satisfactory. This also serves as a check on the control circuit and indicates whether a change in settings would result in improved performance.

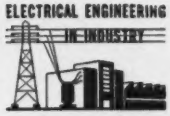
Normally, the control settings are checked once every six months on routine check. At those installations where the voltage support by the capacitor is very essential, units are checked more often, usually by installing a recording voltmeter for a period of several days every two or three months.

Each unit is given a thorough visual inspection once or twice a year. Although experience has not yet determined a final inspection schedule for the oil switch, the present setup calls for a complete inspection each year. However, this may possibly be extended depending upon operating experience. The average number of operations are three or four closings and three or four openings for each day, excluding weekends.

Other Installations . . . In addition to the three-step, 12-kv capacitors already discussed, PP&L is using pole-mounted 4-kv, 180 kva, automatically switched capacitors, both metal-enclosed and open-type. Typical installations are illustrated above, left and center. An experimental single-phase unit for 7.2-kv, heavily loaded rural lines is shown above on the right. This installation consists of six 15-kva capacitors.

Why One Paper Mill Turned To Purchased Power

Conversion to utility power from "free water power" cuts production losses enough to pay for conversion project. Low-water "down-time" is eliminated by using purchased power



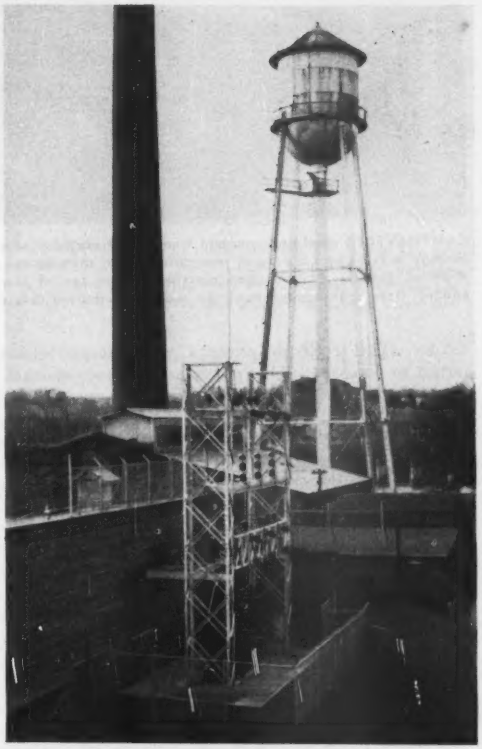
EMILE GORHAM, Consulting Engineer
Union City, N. J.

"Free water power" proved to be one of the most expensive operating costs at the Thomson, N. Y., mill of the United Board & Carton Corp. Expensive because it was undependable; because when there was little or no power, many tons of production were lost; because maintenance costs were high when they included teams of men, usually at "time and a half" clearing ice or other debris from the trash racks.

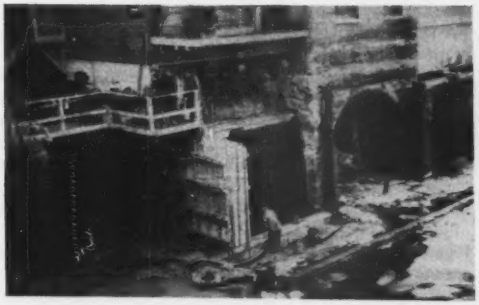
To eliminate such conditions United's management approved an expenditure of $70,000 for facilities and improvements permitting the use of purchased power in the mill. The costs of this project will be returned in the form of reduced operating costs and increased production. "Down-time" on the paper machine chargeable to lack of water power will be eliminated entirely. Production scheduling of "high-grades," requiring large blocks of power, will no longer be at the mercy of the river.

The Thomson board mill is situated on the upper reaches of the Hudson River where the mill and a few "company" houses comprise the unincorporated village of Thomson, N. Y. When the mill was built in the "nineties," it was set up for the production of ground wood pulp.

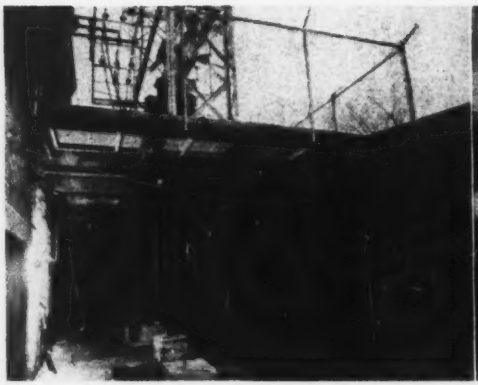
Many Changes Made . . . Since its inception as a mill based on water power, many changes and improvements have been made. The most important change was from ground wood to paperboard. The change-over from ground wood operations, with timber as the raw material, to the manufacture of paperboard, with wastepaper as the raw material was significant of the modern trend in the ever increasing use of paper and paperboard products. Likewise significant was the improvement of power facilities in the mill. This improvement was along the lines of investment in additional hydroelectric generating equipment which was to replace water-driven and steam-driven equipment. This investment placed much greater dependency upon the river and proved to be a serious mistake. This complete dependence upon water power has been costly due to the inevitable power shortages and complete power shutdowns. In an industry where competition, except for a few war years, has always been keen, this could have been dis-



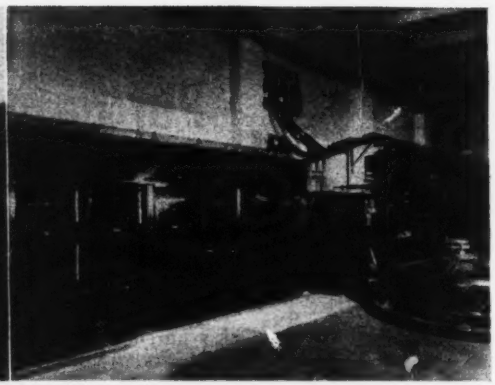
NEW TRANSFORMER PLATFORM and superstructure for 3,500-kva, 33,000—480-v single-phase transformers were installed over forebay in front of present generator room. This location gave shortest secondary run to main distribution board as well as the most convenient run for primary service



TRASH RACKS in front of spillways frequently clogged with ice and were damaged, reducing water flow to generator wheels



CANTILEVERED steel and concrete transformer platform over forebay in front of the present generating room, showing construction details. This location permits shortest run of secondary from transformer bank to main distribution board



NEW SWITCHBOARD with double-throw switches in foreground, main breaker adjacent and meter panel partly behind breaker. Note wall-mounted disconnects between breaker and outside bus. Old twelve-section switchboard is at far right

astrous. That is why the present United management has turned to purchased utility power as an answer to insufficient water power and all the problems it poses.

Modernization Plans . . . In line with this modern thinking, plans for the modernization of power facilities at the Thomson mill were authorized. Engineering surveys and studies were made so that present and future requirements could be evaluated in terms of the realities of existing conditions. Final plans and all necessary construction details were made and furthered to realization within a few months.

The inadequacies of the existing power plant showed up early and easily in the preliminary surveys of power generating capacity vs actual mill loads. A brief review of these studies is necessary for complete understanding

Mechanical and electric power to plant equipment was furnished by three methods:

1. Steam prime movers driving constant and variable speed line shafts and electric generators.
2. Water wheel turbines driving constant speed line shaft.
3. Water wheel turbines driving electric generators.

As disturbance to the steam balance in the mill was not considered desirable, no change in steam prime movers was contemplated or necessary. The steam driven generators were considered as a source of firm power.

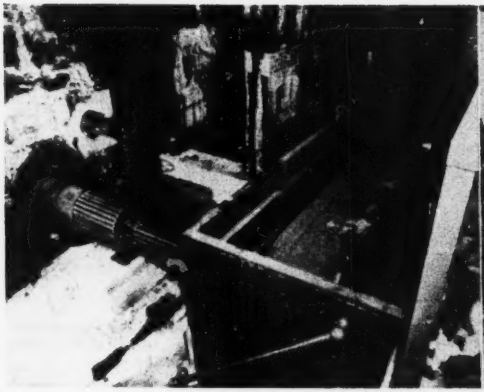
Item No. 2 was, on the other hand, a constant source of trouble and unreliable power. Power varied with water conditions and the speed of the line shaft was far from constant as it should have been. Motorization of equipment driven by this line shaft was a necessity if full advantage was to be realized of a steady source of power, such as purchased utility power.

Biggest Trouble Spot . . . The water driven electric generators was the biggest trouble spot in the mill. Hydroelectric power was generated and distributed through the mill at 440 v, 3-phase, 50 cycles. The total connected electric load in the mill of 2,600 hp (1,940 kw) was being met with a generating capacity of 1,520 kw at full head of water (17 ft). Even with a mill demand factor of 70%, the power factor being not over 70%, there still was an apparent deficiency of about 400 kw even under the most favorable generating conditions—which rarely prevailed.

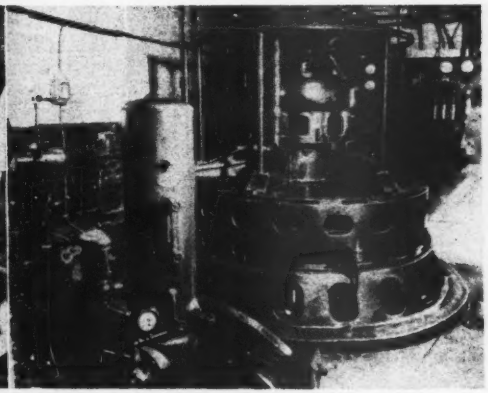
Low head water, high tail water, ice, leaves, weeds and all other forces of nature conspired to reduce the plant generating capacity in all seasons of the year. In the spring it was floods, in the summer it was droughts, in the fall it was leaves. The winter brought ice—"shell" ice floating on top the water, clogging the trash racks, reducing the water head; the much dreaded "anchor ice"—will-o'-the-wisp of the river floating practically invisible just below the surface of the water which, when it struck a surface like steel in the trash racks and the water wheel runners, stuck fast. If one were lucky only the racks would plug up, but if one were unlucky, the turbine runners would get fouled up and become damaged.

Water Available . . . However, the amount of water available for power generation was always the common denominator for any mill efficiency figures. The flow of the Hudson River at this point is controlled by New York State Sacandaga Control Commission. Actual physical control is exercised at the Sacandaga Dam, used by the Niagara-Mohawk for hydroelectric power generation, but which was constructed primarily for flood control. While the Commission has done much to even out the river flow from the "feast-or-famine" conditions of the years prior to control, regulated flow has left much to be desired. Both quantity and availability of water required has rarely coincided with mill needs. As an example, more usually than not, the flow of water on Mondays was so slight, that mill production could not start before noon and often not until Tuesday. It is evident that the amount of production lost for this reason has been very high and it was conditions such as these that the new power facilities were designed to overcome. The elimination of production losses will pay for the cost of the entire project.

Secondary effects of low water troubles furthering plant



WATER WHEEL behind wall on the left formerly powered shaft in foreground which operated three pulp beaters. New electric motors powered by utility service now drive beaters. In case of utility outage, old mill generating capacity keeps mill running



LARGEST GENERATOR of the four in the mill is 300 kva and connected to a vertical water wheel. At left is the governor which regulates pitch of the water wheel blades. Advantages of paralleling mill and utility power did not justify extra cost

inefficiency were low voltage, low frequencies, overheating of motors and equipment, motor slow-downs, etc, so that quality as well as quantity of production suffered through poor or insufficient stock treatment. Last, but not least, was the inability to schedule production of high grades requiring large blocks of power for treatment and refining, to correspond with customer demand. High grades had to be fitted into the production schedule "when and if" power conditions were "right."

The general power program was many-sided and several unique features are noteworthy:

1. Location of Transformers . . . The transformer bank is located on an elevated steel and concrete platform cantilevered over the forebay in front of the present generator room. This was the best place to put the transformers because it meant the shortest run of secondary from the transformer bank to the main distribution board. With secondary distribution of 2,000 amps at 480 v, every foot of copper saved was worthwhile saving. The power company was also happy with this location as it offered the most convenient run for their primary, which was a 33,000-v, 3-phase, 4-wire grounded neutral service.

2. Selection of Transformers . . . While economy was the watchword for this project, security, dependability and reliability were considered important and desirable ingredients. The decision to purchase three single-phase transformers rather than one three-phase transformer was not lightly made; nor was it guided by initial costs alone. Three single-phase transformers will guarantee a constant source of power even in the event of failure of one of the units. Operation of two transformers in "open delta" will supply up to 60% of the total capacity of the bank.

The transformers purchased, including certain recommendations and requirements of the power company, were three 500-kva single-phase units, 33,000—480-v, Y-delta.

3. Separation of Mill and Utility Power . . . Where purchased power is used in conjunction with the mill-generated power, normal practice dictates paralleling the two power services. Benefits to the mill accrue in the form of voltage and frequency correction of mill generated power. Usually this is not only desirable, but mandatory where mill generating equipment cannot supply power with normal current characteristics. However, in this case, voltage and frequency correction were not sufficiently attractive advantages when compared with all the disadvantages.

First of all, the existing mill switchboard included old type oil circuit breakers having interrupting capacity far below requirements for any equipment connection to utility power. Obviously then, if mill power and utility power were to be paralleled on a common bus, a new switchboard was necessary, complete with air breakers of the proper interrupting capacity. The cost of such a new board was more than management was prepared to pay.

Secondly, paralleling involved some rather elaborate protective relaying equipment which merely increased the cost of the switchboard. Protective relaying is not necessary if the power systems are kept separate.

Thirdly, paralleling required synchronizing equipment, another expense and, of course, additional delicate duties for the power room operators when synchronizing a generator with the utility system.

Switchboard . . . For these reasons, it was decided that there was more to be gained, cost-wise and operation-wise, by keeping the two systems separated. This was accomplished by erecting a "selective" switchboard consisting of several double-throw switches through which the plant load centers can be served by either power source. This switching arrangement is extremely simple to operate and it was very economical to build.

The selective switchboard gives the operators wise latitude in choice of power, not only between utility and mill power, but also selection of mill generators which should be applied to the loads. Mill generators are shutdown on a schedule basis for inspection, preventive maintenance and just plain rest. Planned regular shutdown of generators was never done on a "hit-and-run" basis during weekend shutdowns.

FIG 1—IN NEW APARTMENT BUILDINGS metering is of the socket trough type to eliminate problems of ganging single sockets. Meters are outdoors where conditions permit

FIG. 2—WHERE A MAIN SWITCH IS REQUIRED for an apartment building the metering is indoors. In this 8-apartment building, two 4-meter socket troughs do the job

Modern Facilities Solve Problems Of Metering Expanding Loads

As customer loads continue to increase Wichita utility has turned for solution to: Socket troughs for apartment houses; transformer-rated single-phase socket meters for special loads and 3-phase pole-mounted socket meters for tamper proof installation

RALPH LONGSTAFF, Kansas Gas & Electric Co
Wichita, Kansas

Today's growing loads have brought an increasing number of complex metering problems to the Kansas Gas and Electric Co. However, all of these problems have been solved, in recent years, through the extensive application of modern metering facilities. Solutions to most of them can be briefly summarized in the following five simple rules:

1. Use multi-meter socket troughs for apartment buildings requiring several single-phase meters.

2. Use heavy duty socket troughs for 50-amp, single-phase, modern type socket meters.

3. Use current transformers for heavy single-phase loads instead of risking a badly overloaded self-contained meter.

4. For large "community center" type commercial buildings that have several tenants on separate meters, install metering equipment inside where it is accessible to both tenants and the company.

5. Use a transformer-rated polyphase socket meter where it is an advantage to have a small meter enclosure on the pole and a nearly "tamper-proof" installation.

In examining KG & E's metering methods in detail three important points should be kept in mind: (1) Outdoor metering is required where practicable, (2) power and lighting are, with few exceptions, on the same service, through totalized kwhr and demand metering and (3) except for residential service, most schedules are based on a 15-min peak demand period.

New Apartment Buildings . . . In metering new apartment buildings KG & E has utilized multi-meter devices of the socket-trough type shown in Fig 1 and 2. The socket trough eliminates many of the problems encountered in ganging single sockets and provides ample wiring space back of meters. Less wall space is required and when load wires are run out through the rear of the trough, much unsightly service entrance wiring is eliminated from the outside of the building. However, with the socket trough it is difficult to disconnect one meter of a group, if for any reason it becomes necessary to discontinue service from that meter.

Heavy-Duty Single Phase . . . In the past it has been difficult to use modern-type socket meters for 50-100-amp single-phase loads, due to the lack of wiring space in the conventional meter socket. This problem is being met by using heavy-duty socket troughs that have a 2½-in. hub in top. These trough-type sockets with their additional wire-way accommodate wire sizes up to 3/0.

Current transformers are used on

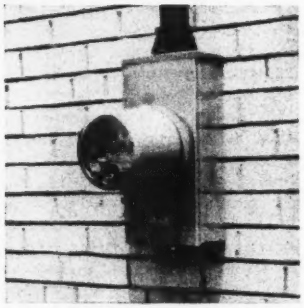


FIG 3—SOCKET TROUGHS, heavy duty, with 2½-in. hub used where 1-phase loads need 50-100 amp socket meters

single-phase loads when required. These loads are metered with either a transformer-rated 3-wire, single-phase, single-element, 230-v meter or with a two-element, 3-wire, 3-phase, 115-v meter as shown in Fig. 4.

Polyphase Metering Practice . . . Customer's wishes govern in the matter of outdoor vs indoor metering of polyphase loads, provided no other matters of company policy are involved.

One large L-shaped building which houses 16 commercial establishments is served 3-phase, 4-wire delta, with service wires of two 300-Mcm per phase in parallel. Metering sequence is main circuit breaker, to trough, then through 17 separate switches and meters to customer's load. Meters, located in basement, are mounted on top of connection boxes, as in Fig 5, which house the test block. With this arrangement meters are easily accessible for servicing, reading, and resetting demand registers. On this installation, two elements of a 6-wire meter were used to meter the 3-phase 4-wire delta service because of a shortage of 4-wire meters at the time of installation.

The polyphase socket meter has the advantage of requiring a very small enclosure, making it a good meter for pole mounting, especially on rack poles where climbing space should be kept as clear as possible. This is illustrated by the installation of a socket-type 3-phase, 4-wire wye, transformer-rated meter for a new school building pictured in Fig 6. The 300-amp outdoor current transformers are mounted on one end of the two-pole rack and the socket meter on

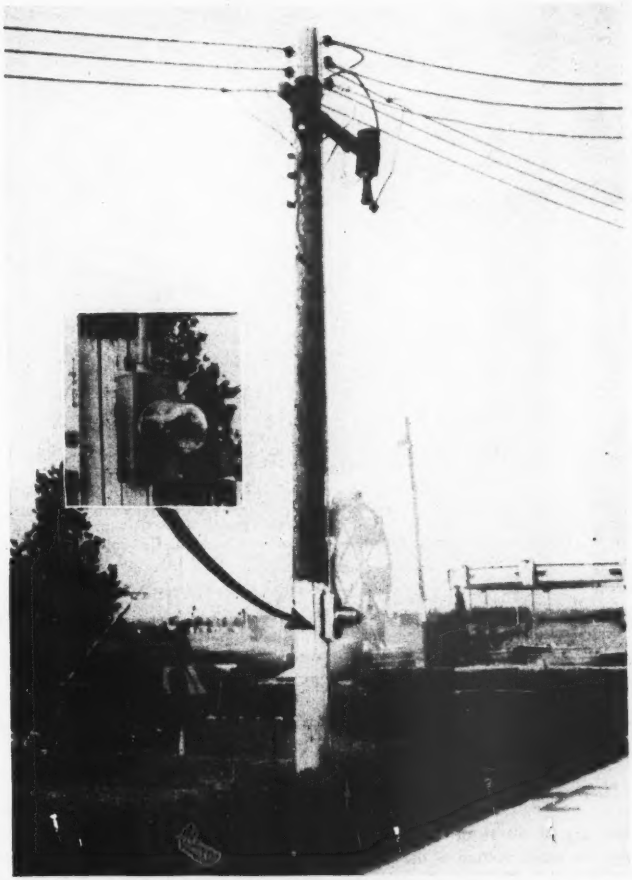


FIG 4—AMUSEMENT PARK LOAD (single-phase) is metered with transformer-rated, 3-wire, 3-phase, 115-v, socket-type meter using two 200-amp CT's

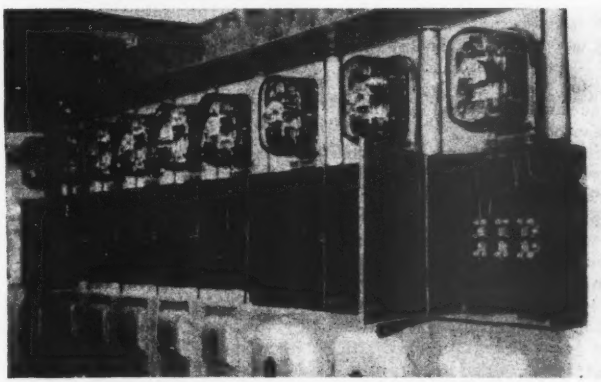


FIG 5—COMMERCIAL BUILDING metering, located in basement, meters each establishment separately. Meters are readily accessible for servicing and reading

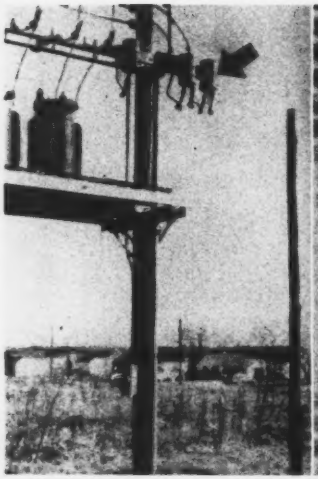


FIG 6—POLYPHASE SOCKET METERS require a small enclosure making them adaptable for pole metering. The current transformers (arrow) are 300 amp

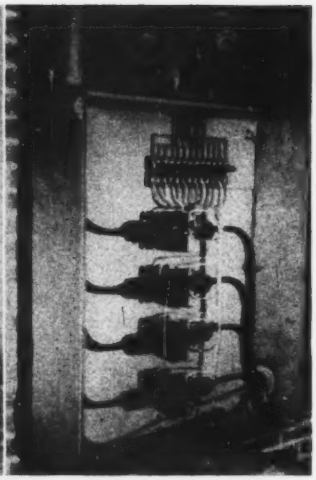


FIG 7—TRANSFORMER-RATED METER with 200-amp current transformers, all located inside in this case, meters 6-wire service for large super-market

one of the rack poles. Service is underground to the building. This type of installation leaves the meter equipment easily accessible for servicing or changes and makes a nearly tamper-proof meter and enclosure, which is desirable for school yards.

Commercial establishments are often surrounded by parking lots and service drives which leave insufficient clearance for outdoor metering equipment. Many times outdoor meter installations which seem to have adequate clearance prove no match for some oversize truck; so where there is any doubt and where conditions permit, the meter is installed inside. Two large grocery super markets were recently served six-wire and metered with transformer-rated meters using 200-amp current transformers. In one installation the entire metering equipment is inside, having four indoor current transformers and the test block mounted in a steel enclosure with the meter mounted on top of the enclosure as in Fig 7. The other installation did not have space available inside for the transformer enclosure; so four outdoor current transformers were mounted outside on the building wall and the control wires run inside the building to the six-wire meter.

A number of high-current meter installations in large buildings in downtown Wichita are served from a 3-phase, 4-wire wye, 120/208-v underground system. The average large building is served with four 500 Mcm conductors per phase and 1,500 amp current transformers, although larger equipment is used as needed.

Cable Laid Under River in Record 74 Hours

Burying of 80 ft of 12-kv cable under the sandy bottom of the Fraser River was completed in a record 74 hr by British Columbia Electric Co in its first combined cable-laying and dredging operation. This record time, which includes the time cable left BCE supply depot until final splicing, is the fastest job ever handled by the contractor, West Coast Dredging Co. The line links Marpole and Sea Island, near Vancouver.

To begin the operation, a trench, 50 ft wide at the top and from 5 to 20 ft deep, was cut in the river bottom by a five-bladed, 52-in. head dredge drill. Next, a 16-in. 80,000-gpm suction pump, equipped with an 18-in. suction tube and a 16-in. discharge tube, sucked in the loosened sand. This sand-water mixture was carried by pipe across an attached scow, and shot jet-fashion back into the river. At the same time, 4-in. steel-armored cable was reeled into the trench from the scow. Loosened sand settled back over the cable to form a protective layer.

DREDGING AND CABLE LAYING operations were combined, above, in laying 800 ft of 12-kv cable in 74 hr under Fraser River near Vancouver, British Columbia. Cable was reeled into the trench, loosened sand settling over the cable

An additional 700 ft of underground cable was laid on the mainland to connect the new line with the Kidd substation. On the south side of the river, the underwater cable was tied into Sea Island distribution system.

The cable reinforces supply to Vancouver International Airport and Island industries generally. The cost of this three-day project came to approximately $21,000.

THREE REPETITIVE-MANUFACTURE TRANSFORMERS installed at a substation of a large utility in southeast Texas. They are each rated 1000-kva, single-phase, 67,000 volts to 7620/13200Y. Cylindrical auxiliary tanks contain oil and an inert gas which excludes oxygen, preserves the insulating oil in main tanks.

Utility Saves 7 Weeks and $3054 on Six Transformers by Ordering RM

Lower prices and faster shipments have sold a Southeast Texas Utility on the RM* idea.

A recent specific order shows why: Six transformers were ordered for two important substations. Each was a single-phase, 1000-kva unit—step-down from 67,000 volts to 7620/13200 volts Y. The net price for one of these RM units was $5738, while the net price for a comparable nonstandard transformer was $6247. Total saving—because the utility purchased RM—was $3054, and what is equally important, shipment was made in 11 weeks, versus an average delivery at that time of 18 weeks on non-standard transformers of similar ratings.

Are you taking full advantage of RM? Available in single- and three-phase ratings, with or without load-ratio control and fan cooling, RM transformers are easy to apply to your system. For complete listings and application information, write for Bulletin GEC-479, *Apparatus Department, General Electric Co., Schenectady 5, N.Y.*

*RM stands for "Repetitive Manufacture." By using standardized construction methods, General Electric builds RM power transformers more economically—delivers them faster. RM designs are available in ratings 10,000 kva and below and up to 69-kv, with many optional features.

GENERAL ELECTRIC

HOW TO DESIGN • CONSTRUCT OPERATE • MAINTAIN

"Party Line" Telephone Aids Underground Work

CRANK-TYPE TELEPHONES permit workmen in vaults (left) to be in constant contact with superintendent of underground department in his office (right). Phones are standard equipment for cable splicers who install them in vaults

Contact with underground crews is made easier by a "party line" telephone, installed by Arkansas Power and Light Co in its Little Rock underground system. An independent network of telephone circuits was installed in the conduit system. These circuits are connected with all 175 underground vaults, with the office of the underground superintendent, and with the trouble dispatcher's desk at the Little Rock power plant.

Plugs for telephones are installed in each vault. An army crank-type field telephone is carried by each cable splicer as part of his standard equipment. Telephones in the office of the underground superintendent and the trouble dispatcher are permanent.

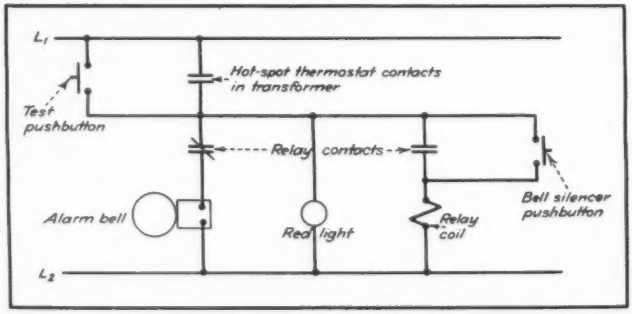
When a splicer enters a vault he reports to the underground superintendent who notifies the trouble dispatcher of the presence of workmen in the vault. The dispatcher or the superintendent can then give workmen instructions and can get in touch with them at any time. Likewise, workmen can report progress from time to time and ask for further instructions when they are needed.

Overload Alarm Circuit Resets Automatically

FRANK E. REEVES
Senior Electrical Engineer
Barnard & Burk
Baton Rouge, La.

An alarm circuit for indicating hot spots on a large power transformer has these features: (1) It automatically resets after the transformer cools below the danger point; (2) it permits the silencing of the alarm bell without turning off the red warning light. This circuit eliminates the possibility of forgetting to reset the circuit.

In operation, when the thermostat contacts close, the alarm rings and the red light is energized, indicating that the transformer is overheated. The alarm bell may be silenced by pressing a push button which locks up a single-pole double-throw relay. The red light remains energized to show that the overheated condition still exists. When the transformer temperature is reduced sufficiently to cause the thermostat contacts to open, the red light will go out and the circuit will reset, ready for the next closure.



ALARM CIRCUIT for large power transformer sounds an alarm and lights a red light when transformer overheats. Alarm may be silenced without turning off light

A test push button enables the circuit to be tested at any time. When it is actuated it energizes the alarm bell and the red light. With the test push button held closed, the bell silencer push button is actuated to silence the bell. When the test button is released, the red light will go out.

Now! more Cutout for the same money

HEAVY DUTY FUSE CUTOUTS

THE NEW G-E 100-AMPERE HEAVY-DUTY FUSE CUTOUT GIVES YOU

- **1 cutout for either 50- or 100-ampere requirements—with positive full range operation.**
- **Interrupting ratings of: 8000 Amperes at 2.5 KV**
  5000 Amperes at 5.2 KV

YET IT COSTS NO MORE THAN ITS 50-AMP PREDECESSOR

OTHER FEATURES

- **POSITIVE INDICATION** of blown fuse is given by a double spring-operated indicator arm.
- **FLASHOVER PREVENTED** by a synthetic sponge-rubber barrier cemented to the cover.
- **RECOIL CUSHION** is achieved by springs located between the door and the hinge.
- **CLEAR IDENTIFICATION** from the ground is assured by a white disc monogram.
- **CORROSION SHIELDED** terminals and contacts.
- **EEI-NEMA STANDARD** mounting bracket provides side swivel and vertical or angle-tilted mountings.

Cutout door without fuse link

Interior of cutout housing

YOU'LL LIKE THE ECONOMY AND RELIABILITY OF THIS NEW GENERAL ELECTRIC CUTOUT FOR YOUR HIGH CAPACITY FEEDERS. SEE YOUR LOCAL G-E REPRESENTATIVE FOR COMPLETE DETAILS, OR WRITE FOR BULLETIN GEC-704.

Apparatus Department, General Electric Company, Schenectady 5, New York

GENERAL ELECTRIC

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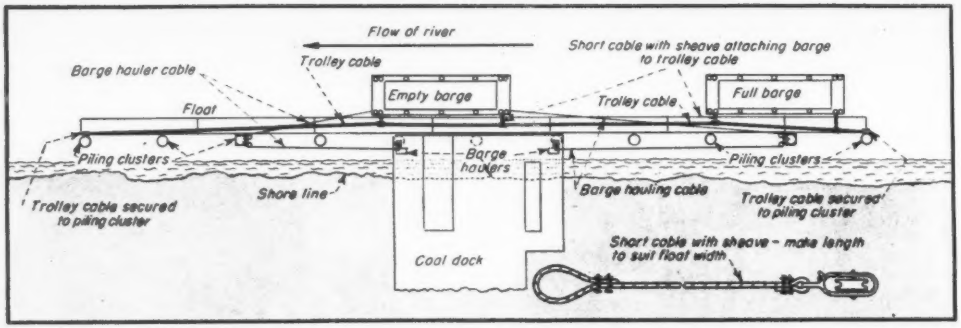


COAL-BARGE HANDLING FACILITIES—Empty barge is ready to have the barge-hauler cables cast off and start downstream to tie-off while hauler cables are moved upstream and attached to full barge. This method holds barges close to the dock and floats them downstream when empty without danger of their floating off, and without tying up barge hauling equipment

Trolley Cable Solves Barge Handling Problem

PAUL T. SCHNEIDER
Assistant Superintendent
Philip Sporn Plant
Central Operating Co
New Haven, W. Va.

Handling time of coal barges was reduced 75% at Philip Sporn Plant by an improved method of rigging the cables holding the barges to the unloading dock. This method holds barges close to the dock without danger of breaking the barge-hauler cables.

An old barge-hauler cable was stretched from one end of the dock to the other for use as a trolley cable. Small sheaves ride on this cable and may be attached by short cables to any barge. By using these short cables, it is possible to tie a barge close to the dock or float it downstream when empty without danger of its floating off, and without tying up the barge hauler for a considerable length of time.

Trolley Cable Slopes

Upstream end of the trolley was secured to the piling cluster approximately 4 ft above water level. The downstream end was secured similarly about 12 ft above water level. The resulting slope compensates for the difference in the levels of loaded and unloaded barges and prevents the short cable loops slipping off the barge mooring bits as the empty barge moves downstream.

With barges attached to the trolley cable, it is possible to let an unloaded barge float downstream to the end of the dock where it is tied without any further effort on the part of the barge handling crew. Meanwhile, the barge-hauler cables are cast off the empty barge and transferred to the next loaded barge.

The trolley cable must be raised with a rising river to permit the floats to rise and be in position to handle the barges satisfactorily at the higher elevation.

Because old barge-hauler cable which has been broken and spliced was used for the trolley cable and odd lengths of other cables were used for the short sheave-attached cables, the only expense was for small sheaves and cable clamps and for labor of installation.

Automatic Ground Checks Meter Cases

SEPARATE TESTS for grounded meter cases have been eliminated in the meter test shop of Public Service Co of Northern Illinois. Under a system worked out by Charles Hoffer of the central meter shop, a neon lamp is connected to the meter hanging screw and neutral side of the service on the meter test board. Any meter with a grounded case is readily detected because the neon lamp lights when the test circuit is energized. Safety of testers and installers is assured. Meter test boards can be equipped easily with these automatic ground indicators

THE BEST PROTECTION FOR YOUR DISTRIBUTION SYSTEM

22 million arrester-years *haven't* been wrong! G-E Pellet Arresters hold lightning voltages to lower levels—more consistently over the years—than any other distribution arrester.

Year after year, General Electric Pellet Arresters have continued to provide a combination of low sparkover and low IR drop that holds lightning voltages on the transformer to safer values—safer than with any other distribution arrester.

What's more, these unexcelled protective characteristics remain practically unchanged with time. Dry inert nitrogen (N_2) fills the sealed gap-chamber and prevents the formation of ozones and oxides. Gap electrodes stay bright as new, and low sparkover characteristics are stabilized. Sealed-in-nitrogen construction is *exclusive* with G-E Pellet Arresters.

The pellets, of lead dioxide, are actually formed with water in a tumbling barrel. Providing valve action with exceptionally low IR drop, they are unaffected by atmospheric moisture, condensation or humidity.

These features mean the best in protection—achieved through 22 million arrester-years of operational experience. This pellet arrester service record is unapproached by any other distribution arrester.

Don't gamble when you buy protection—insist on G-E Pellet Arresters for your distribution system. *Apparatus Dept., General Electric Co., Schenectady 5, N. Y.*

GENERAL ELECTRIC

CONVENTIONAL substation battery installation was not suitable for Manayunk substation. A set-up of this type would have required knocking out a wall of the battery room

NICKEL-CADMIUM, 95-cell battery installation was chosen because Manayunk substation is unattended and a reliable set-up requiring minimum attention was desired

Nickel-Cadmium Batteries Installed In Substation

EDWARD BARROW
P. B. WICKERSHAM
Philadelphia Electric Co
Philadelphia, Pa.

Installation of nickel-cadmium storage batteries at Manayunk substation of Philadelphia Electric Co was influenced by these factors. We were looking for a unit with long life, and, because the station is unattended, one that would function reliably with a minimum of attention and checking. Furthermore, a unit that would not require monthly overcharging would facilitate operation of the supervisory control system, eliminating the necessity of having to operate the substation manually for the 8-hr overcharging period.

An additional requirement at Manayunk, that of space saving, indicated that a nickel-cadmium installation would avoid the necessity of knocking out a wall of the battery room.

For these reasons, a 95-cell, nickel-cadmium-alkaline battery, manufactured by Nickel Cadmium Battery Corp, was chosen to supply nominal 125-v, 2-wire service to remote-controlled circuit breakers, emergency lights and to the receiving end of supervisory control service. A 3½-kw, shunt-wound m-g set furnishes a normal float charge of 132 v (1.39 v per cell). Operation of supervisory control receiving equipment demanded a voltage range between 105 and 135 v (1.11 and 1.42 v per cell) which is below the gassing point of 1.47 v for this type cell. Because operation of the battery did not cause the gassing point to be reached, no water was added during the year of operation and the battery is in good condition.

Our maintenance department reports that, over the past year, inspection and checking of this installation embraced: (1) Voltage reading once a month, (2) specific gravity test once every six months, once a year from now on, (3) electrolyte level check once every three months, and once every six months thereafter and (4) cleaning of cells, connections and racks once a year, and once every two years hereafter. This procedure is continuing on an experimental basis and inspection requirements will be reduced if experience justifies.

With only a year's experience, we are not in a position to comment on the long life characteristics of nickel-cadmium batteries, other than to base life expectancy on European experience, which has indicated a life of 25 years or more.

Performance Requirements

In practice a temperature differential of 10 F between top and bottom tiers of batteries has been noted in some installations. Discharge rates of the new installation appear to be unaffected by temperature differentials of this order.

Performance requirements for the fully charged battery at an ambient room temperature of 77 F (average) call for a load of 14.5 amp continuously for 1 hr and in addition, at any time during this period, the ability to provide for 60 successive circuit breaker operations, each super-imposing an additional load of 140.0 amp for 1 sec, without dropping below 105 v at battery terminals during discharge. At an ambient room temperature of 40 F, the same delivery requirements must be met while maintaining at least 100 v at battery terminals. Because this type battery shows no appreciable drop in rate at the required change in temperature, it is possible to use a smaller size battery to meet the 77 F operating condition.

Since this type cell can be stored fully charged for long periods without apparent damage, due to the low self discharge and lack of sulphation of the negative plate, it has the advantage of not requiring attention when unavoidable delay is experienced in the construction of a new substation.

The curriculum at our operator's training school now includes complete data on the design, behavior and maintenance of nickel-cadmium-alkaline batteries. Our current installation at Manayunk substation, at least through its experimental stages, is receiving careful observation by our operating personnel.

YOU GET POSITIVE CO-ORDINATION—WITH BREAKERS, WITH RECLOSERS IN SERIES, AND WITH FUSES

The rugged mechanical timer of the FR-1 operates in air. Its time-current characteristics remain exactly as published regardless of temperature, or viscosity changes of oil.

Holds Service Trips to Minimum

The FR-1 resets in a matter of seconds. You avoid unnecessary fuse blowing and recloser lockouts from rapidly recurring faults.

Picks Up the Load Easily

Inrush current can't lockout the FR-1. It has an exclusive "time-delay" function—holds closed until inrush currents have subsided, then automatically resets for normal operation. This also permits the use of fewer sectionalizing points—makes possible a saving in system investment.

No other recloser combines all the essential features of the FR-1. For a more complete story, write for GEA-4934. Address your nearest G-E Apparatus Sales Office or *Apparatus Dept., General Electric Company, Schenectady 5, New York.*

GENERAL ELECTRIC

853-50

Method for Computing Steady-State Power Limits of Transmission Systems

G. W. BILLS, and R. S. SEYMOUR, Electrical Engineers, Bonneville Power Administration, Portland, Ore.

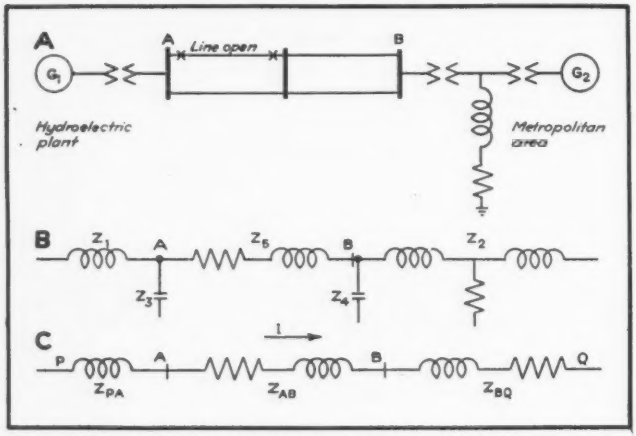


FIG 1—(A) A 230-KV TRANSMISSION SYSTEM for supplying a metropolitan area from a hydroelectric plant. (B) Equivalent π of the line and terminal equipment. (C) Equivalent to be used in circle diagram

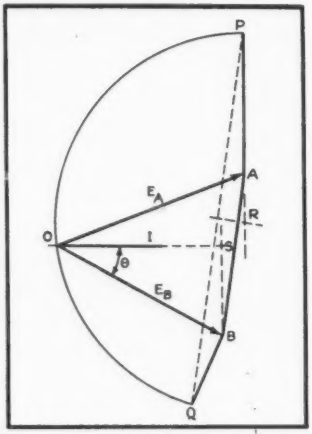


FIG 2—MAXIMUM POWER determined for transmission system on equivalent line and end impedances

Maximum stability power that can be transmitted on a system is determined by graphical solution

A method has been developed to calculate the steady-state power limit, for a transmission system consisting of the following: An isolated generating plant supplying power over a long transmission line to a metropolitan area generating a major portion of its load locally.

Solution is applicable to cases which can be simplified to a two-synchronous machine problem with both machines acting as generators, and with the pull-out angle of the sending-end generator the criterion.

To illustrate the method, assume the steady-state limit is desired for the system shown in Fig 1A, B, and C. By choosing a suitable scale and using the current as a horizontal reference vector, a diagram of impedance is constructed as in Fig 2, to represent the equivalent of the system as shown in Fig 1C. In Fig 2, PA is the reactance calculated by paralleling the sum of the reactances of the transformer and the generator of the sending-end with the pillar reactance of the line. AB is the line impedance, and BQ the equivalent impedance of the receiver-end. This equivalent impedance can be easily calculated by paralleling the pillar resistance and the end-reactance on the right side of Fig 1B, adding this to the receiving-end transformer reactance and then paralleling the result with the right pillar impedance of the line. PQ is the total equivalent impedance of Fig 1C. The next step is that of bisecting PQ by a perpendicular bisector (Fig 2).

Up to this point the process is identical with that used by Clarke[1] in a two-machine problem with the receiving-end motoring. Now instead of computing a correction angle and employing it in the construction, a vertical line is drawn perpendicular to the horizontal reference current vector through A until it intersects the perpendicular bisector at R. With R as center and P and Q as points on a circle's arc, a circle can be circumscribed. A point O on the circle can be found for which $OA/OB = E/E_B$. Since E_A and E_B are known, the scale for E can be determined by measuring OA or OB. Also $I = E_B$ (in volts)/OB (in ohms) $= K$. Then $P_B = E_B I \cos\Theta = E_B K \cos\Theta = E_B K\ (OS)/(OB) = (OS)\ (K^2)$.

Thus P_{BM} (maximum power that can be received at point B) is found by measuring OS and multiplying by constant K^2.

An example displays the case with which power limits are found using the complete graphical solution for the case where the sending-end generator is the first to reach a maximum angle.

Example . . . Transmission line: 200 mile, 230-kv, wood-pole line, double-circuit, one sectionalizing station, with one sending-end circuit out.

Receiver equipment rating: 250,000 kw at 215 kv.

Sending-end equipment rating: 269,000 kw at 230 kv (1.075 x receiver equipment rating)

$\bar{Z}^1$ = Impedance of sending-end generator and transformer = (j47.5) percent = + j93.41 ohms

Z^2 = equivalent series impedance of receiver equipment = (10 + j25) percent = 18.49 + j46.23 ohms

Z^3 = impedance of sending-end pillar of equivalent π line = − j 1.823 ohms

Z^4 = impedance of receiver pillar of equivalent π line = − j912 ohms

$\bar{Z}^5 = Z_{AB}$ = impedance of architrave of equivalent π line = 16.9 + j114.0 ohms

$\bar{Z}_{PA} = Z^1Z^3/Z^1 + Z^3$ = impedance of equivalent sending-end system = + j98.5 ohms

$\bar{Z}_{BQ} = Z^2Z^4/Z^2 + Z^4$ = impedance of equivalent receiver system = 20.5 + j48.3 ohms

Using above values for the equivalent circuit given in Fig 1C and making the graphical construction, Fig 2 is obtained.

$K = I = E_B/OB = 215{,}000/132 = 1{,}630$ amp

P_B = Kilowatts of power flowing into point B

$= K^2\ (OS) \times 10^{-3} = (1{,}630)^2\ (115)$

$= 305{,}000$ kw

This answer was checked by finding the steady-state power limit of the system on an ac network analyzer. The limit as determined by the analyzer is 304,000 kw which is in close agreement with the result obtained by the graphical method.

[1] Clarke, E.: "Steady-state Stability in Transmission Systems"; "Transactions AIEE," Vol. XLV, 1926.

AIR-TIGHT SEAL MAKES SPIRAKORE* TRANSFORMERS LAST LONGER

Breathing is stopped in General Electric Spirakore transformers. A Nitrile rubber gasket—resistant to oil, age, sunlight, or operating temperatures—seals every opening in Spirakore transformers. Sealing is so complete that hottest summers and coldest winters won't draw moisture or dust into the tank. Transformer life is prolonged.

With this sealing *accessibility is actually improved.* Unclamp the tank cover and it lifts right off. No adhesives to break—no surfaces to clean before resealing. You even re-use the gasket.

This better sealing is only one of the reasons why Spirakore is the finest transformer you can buy. The full story is told in our new bulletin GEA-5400. If you haven't received your copy ask your G-E representative, or write *Section A 402-103, Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*

* Registered trademark of the General Electric Co.

On large tanks, Nitrile rubber gasket of circular cross-section is compressed as shown. A ring welded to the tank keeps the gasket in place and prevents too much compression.

On small tanks, a Nitrile rubber gasket of square cross-section is compressed between rim of cover and deep-rolled flange on tank. Shown uncompressed.

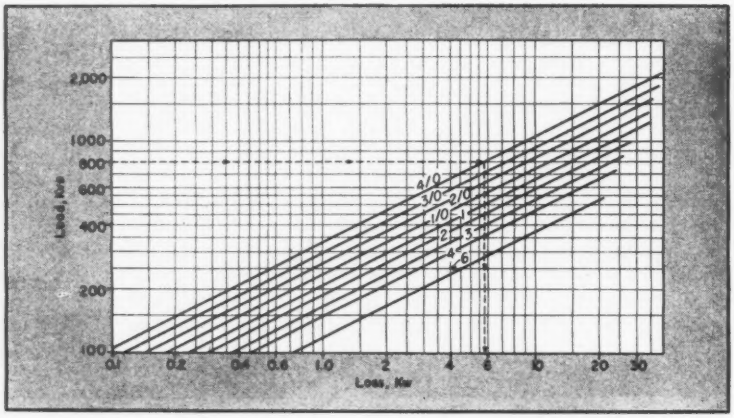
402-103

GENERAL ELECTRIC

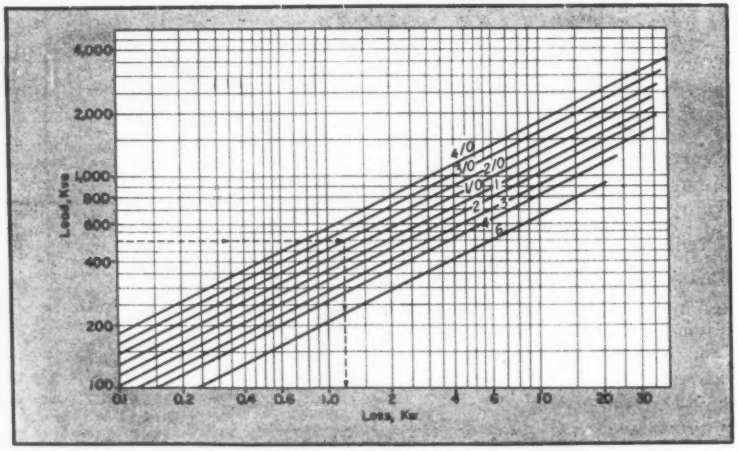
Copper Conductor Power Loss For 2.4-kv and 4.16-kv, 3-phase Circuits

Curves indicate the kw loss per 1,000 ft for various copper conductor sizes and end-of-circuit loads

N. H. ERLANDSON, Distribution Design Engineer, Carolina Power & Light Co, Raleigh, N. C.



POWER LOSS in 2.4-kv, 3-phase circuit, for conductor sizes from No. 6 to 4/0 inclusive. Example: 800 kva load on No. 4/0 conductors, 5.8 kw loss



POWER LOSS in 4.16-kv, 3-phase circuit, for conductor sizes from No. 6 to 4/0 inclusive. Example: 500 kva load on No. 2/0 conductors, 1.2 kw loss

Note: For distances other than the basic distance for which the charts were made the losses vary directly with the length of the circuit, and for other values of load the losses vary as the square of the load.

Condenser Tubes must be . . . KEPT CLEAN

Newport shoots the brushes through the tubes with an air-water gun at 75 lbs. per sq. in. They come from the far end like projectiles. Another Revere contribution was to assist in the design of a target to stop the brushes without damage.

● Condenser tubes almost immediately acquire a film that protects the metal from corrosion. Such film is thin, and beneficial. If it does not form, the probability is that the wrong alloy has been selected. It is part of Revere's service to collaborate with you in selecting the alloy that will be most economical in the long run.

There is another and much heavier type of formation within a tube that impairs its operation, or shortens its life, or both. This is the deposition of foreign matter such as shells, which may cause erosion-corrosion effects, and the growth of organisms such as algae. The latter materially reduce heat transfer.

Take the case of the Newport Electric Corporation, Newport, R.I. Its condensers are cooled by harbor water, with the result that algae and other marine organisms coat the tubes, reducing efficiency, lowering the vacuum, and increasing fuel consumption.

This utility is exceptionally well managed, with a systematic tube-cleaning program. However, it found that brushes and rubber plugs used for cleaning wore out quickly. Revere took a close interest in this problem. One of Revere's customers makes nylon brushes for cleaning tubes in dairies, and it was suggested that a modification of these be tried. Results: over 300 tubes cleaned per brush, a much longer life than anything previously used, and a half-inch gain in vacuum, meaning dollars and cents saved in fuel.

Revere makes condenser tubes and plates in all the usual alloys, and is glad to collaborate not only in specification, but in other condenser problems, as this case history shows. We are only too glad to work with you on any matter involving condenser and heat exchanger operation. Our wide experience, and contacts with many industries will be made freely available to you. Write the nearest Revere office.

REVERE

COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

230 Park Avenue, New York 17, New York

Mills: Baltimore, Md.; Chicago and Clinton, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Rome, N. Y. Sales Offices in Principal Cities, Distributors Everywhere.

Plan Painting of New Plants to Reduce Costs

T. J. EBERHARDT
Secretary, Subox Inc
Hackensack, N. J.

During construction of a power station, attendant dirt and dust of the job make it difficult for painters to produce a neat and uniform decorative finish. Many times surfaces must be cleaned and repainted, increasing costs and inconveniences and retarding completion. Yet when the plant is put into operation, the finish and final decorative effect is judged most exactingly by the owners. The original estimate for painting and decorating, figured by design and planning engineers at the outset, is dwarfed by the final bill. This article will show how much of this "extra" can be eliminated by simple, common understanding and planned painting practices.

First and foremost it is necessary to get steel properly cleaned and shop primed by the fabricator, preferably in his shop before delivery. Air-tight and rigid specifications for this phase of the painting under proper inspection and supervision is necessary. The costs of getting the best possible prime coat are largely offset by on-the-job costs and by reduced future maintenance.

Where mill scale is present on large flat sheets to be exposed to the weather, sandblasting is cheap economy. Where structural steel members are to be painted, extra care should be taken to see that oils and greases are removed and surfaces are free from loose rust and scales before paint is applied. In cases where steel fabricators can not or will not abide by such specifications, it is far better to have steel delivered to the job without any paint. The prime coat should be applied as soon as possible after delivery, and before erection.

Special attention should be given to those members which will be subjected to corrosive conditions resulting from condensation of moisture, such as between interior and exterior walls in all-steel buildings or steel roof decks. These members may be in direct contact with insulation which holds considerable moisture and furthers corrosive conditions. Particularly over boilers, such surfaces may be subjected to high temperatures and high humidity which may cause intermittent moist and dry conditions. Unless the steel is properly prepared and a suitable protective paint applied, these areas threaten to be constant trouble sources in future maintenance.

It is often thought that an extra coat or an "extra heavy coat" of paint on these surfaces will add considerable protection. However, it has been found that increasing the total paint thickness does not give proportionate protection as does the proper surface preparation and application of original base coats.

Lead-base Paints Recommended

The present high costs of lead pigmented paints has caused many steel fabricators to use iron oxide paints or paints pigmented with combinations of iron oxide and zinc chromate as "standard" shop paints. When properly formulated and made, such paints render good service, but in general, paints containing a lead base with a good linseed oil vehicle are recommended. Red lead, blue lead and lead-suboxide are commonly used for this purpose.

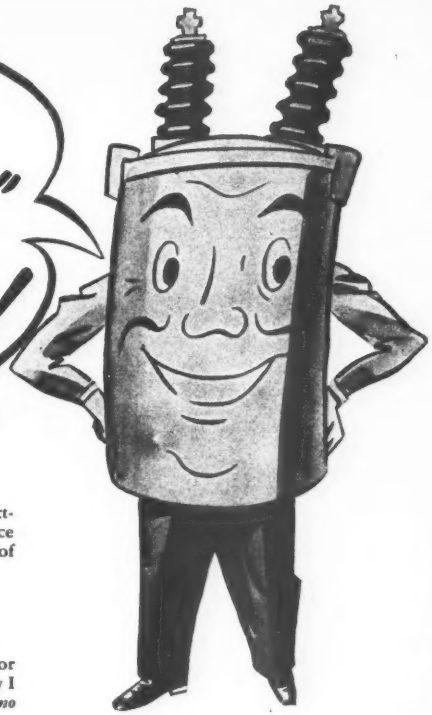
While the latter is the most costly of these, it is the most reactive and thus yields the most dense film which suffers less during transportation, handling and erection. This is important because on many jobs steel delivered months before erection is left exposed on the ground. Good protection is essential for this period.

Asphalt or bituminous paints should never be used for shop priming unless

Rubber Shield Protects Workman

SAFETY ATTACHMENT to pole diggers devised by Hartford Electric Light Co is a simple but effective guard. Operator stands behind the guard facing the auger and is protected against flying debris such as small sticks or stones. Guard consists of ⅜-in. thick rubber belting hung on a frame 30 in. square and made of 1¼-in. flat iron strap. This is fastened to a length of 1-in. iron pipe supported by two 1-in. pipe straps mounted on the under side of the truck frame. When not in use the frame and pipe are easily pulled out from under the pipe straps and carried on the truck

I'm an "inhibited" character!



...and that's good!

BECAUSE "Inhibitol", my inhibited transformer oil, satisfactorily performs its functions far longer without maintenance than any non-inhibited transformer oil. This is the result of the action of an inhibitor which retards

(1) oxidation,
(2) acid formation which attacks insulation, and
(3) formation of sludge which slows heat transfer

Add this to my advanced design, which guarantees superior performance even *without* "Inhibitol", and you'll know why I say, "It's good to be an inhibited character" . . . *and at no extra cost!*

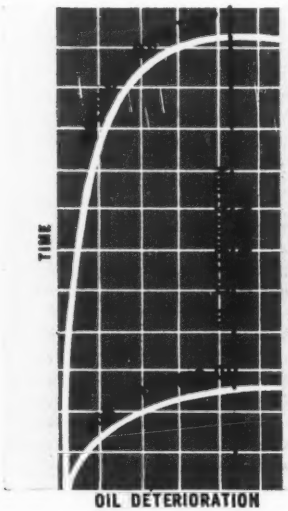
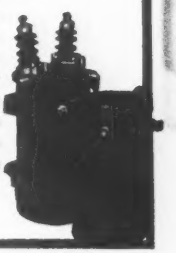


Chart shows result of comparative test of non-inhibited transformer oil and Moloney "Inhibitol". The greater resistance to deterioration obtained with "Inhibitol" results from the use of an inhibitor. The ability of the transformer to resist electrical failure is maintained at a high level for a greater length of time than is obtainable with any non-inhibited transformer oil.

ALSO "VINYLTEX"...

In case you haven't noticed, I'm looking better these days. That's because I'm now covered with baked-on "Vinyltex", the remarkable new vinyl base paint. This is now standard, *at no extra cost either,* to protect me from scratching, scraping or chipping. And as for weather resistance... why "Vinyltex" rivals porcelain in durability, yet is flexible and not brittle.



Send for Bulletin H-305

MOLONEY ELECTRIC COMPANY

Sales offices in all principal cities

FACTORIES AT ST. LOUIS, MISSOURI AND TORONTO, ONTARIO, CANADA

a similar type paint is necessary for the final or finish coat to meet special exposures. Non-descript vehicles in priming paints often cause future difficulties in paint adhesion and should be avoided.

The initial period of plant operation usually shows some faults which cause changes in the layout of machinery, processes and equipment. These changes create dirt and dust and can cause mechanical damage to the paint film. As decorative paint systems are thus spoiled, it is best NOT to apply such color-styling finishes during construction. Instead a "shake-down" period should be allowed and only a single field coat should be applied.

This single field coat should have a lead base so as to be thoroughly rust-inhibitive. It should be formulated with either a treated linseed, tung oil or synthetic resin vehicle to be compatible with the prime coat. It should render a semi-gloss or "matt" finish which will form a good base for final decorative color-styling paints and yet will be both smooth enough for easy cleaning. Also, it should be hard and durable enough to withstand weathering and general plant exposures for a minimum of five years.

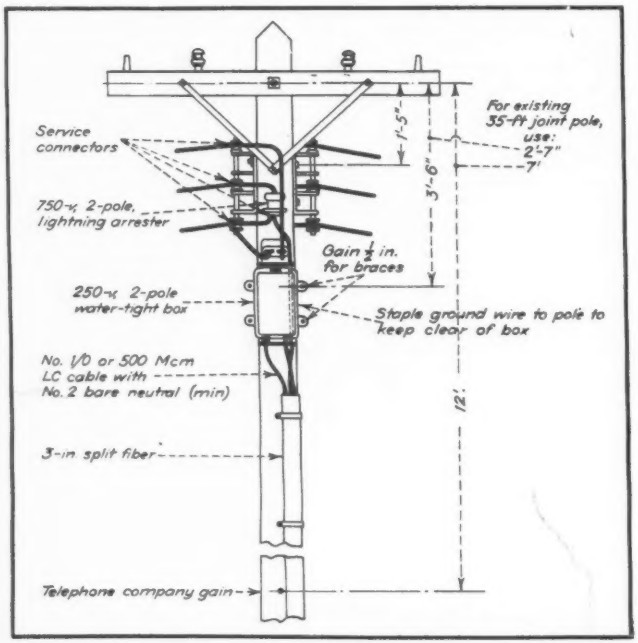
Paints made with lead-suboxide and aluminum give a metallic finish which blends well with galvanized structures, stainless steel and aluminum. Similar lead base paints, made to match the common blue-gray colors of electrical equipment, possess the necessary qualities for this field coat. Olive green is another favorite color for this field coat as it is most neutral and does not show up dirt and discolorations caused by construction crews. It blends well with buff walls and floor tile shades now in use.

Where only this single field coat is applied during construction instead of the usual two or more coats, final painting costs are held nearer to original estimates and savings to the owners are very apparent. By keeping colors and types of paints to an absolute minimum, stock keeping on the job is minimized both during construction and during the original "shake-down" period.

After the "shake-down" period of from two to five years has passed, so that all adjustments to machinery and processes have been completed, the owner can best decide what color styling is best suited to his immediate needs. The job can be done with a minimum of cost or interference with actual plant operations. Steel surfaces will have been well protected during this period and an excellent base established for the next coat or coats.

Exceptions to this general principle of single coat "shake-down" painting are interiors of water tanks, coal and ash handling equipment and similar places which are almost impossible to repaint with the plant in operation. In these cases a third coat applied during construction pays off. Wherever possible this third coat should again contain a lead base so that when future maintenance is necessary, scraping and repriming can be kept to the absolute minimum and the mere application of one more field coat will tend to restore the original film thickness of the established lead coating and prolong its protective life.

Compact Pole Assembly for Subway Terminal



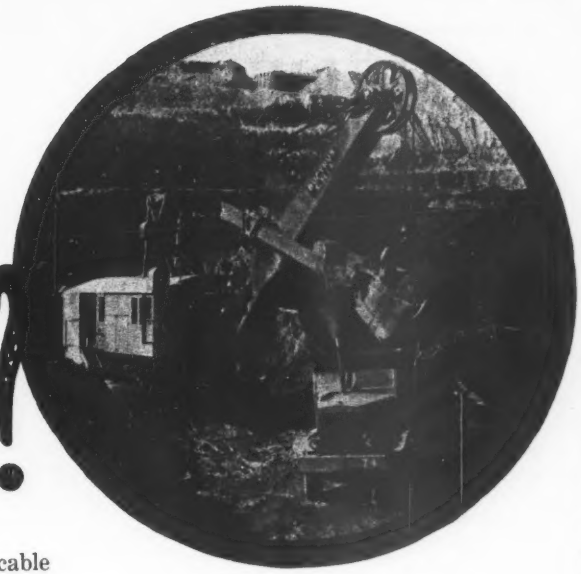
To provide short connections and minimum material in tapping a 230-v, single-phase, 3-wire secondary carried on poles and fed by a subway type transformer, Hartford (Conn.) Electric Light Co uses a compact pole assembly.

A double-pole watertight connection box is mounted below the secondary rack. Ground wire from the 750-v, 2-pole lightning arrester, tapped from the mains, is stapled to the pole to avoid contact with the box. A bare neutral with minimum size of No. 1/0 or a 500 Mcm lead-covered cable is carried down on the pole in a 3-in. split fiber pipe to the transformer. Terminal box on the pole is narrow enough to take up little more space than the pole diameter.

Illustrated is an assembly for a joint-use pole, but which is equally adaptable to single use.

SHORT CONNECTIONS and a minimum of materials result from this straight line 40-ft joint pole layout for 230-v, single-phase, 3-wire terminal tied to subway type transformer

WHY TIREX?



Why is TIREX so often the cord or cable specified to serve portable electric tools and apparatus where operating conditions are severe? Why? Because cured-in-lead Simplex-TIREX Cords and Cables can't be beat for the toughness and electrical stability that are so necessary to efficient portable cord and cable performance.

In the operation pictured above, for instance, a TIREX cable is expected to, and does, deliver unfailing service to the giant shovel that's loading valuable iron deposits on the Mesabi range. The performance of the cable largely determines the shovel's output. And output must be high!

But look at the conditions under which the cable must work. It is dragged over abrasive iron ore, subjected to runovers by trucks and shovel crawlers. It is exposed to burning sun or foul weather, and to the hazards of grease and oil. Only a cable design that provides extra toughness and lasting stability of its electrical properties will carry on under punishment like that.

Such a design is standard for all TIREX products. It is your assurance of satisfaction from every investment in TIREX Portable Cords and Cables. Whether you're equipping small hand tools, heavy machinery, motors, welding or lighting units, specify and be sure that you get genuine Simplex-TIREX Cords and Cables. For complete information, write us direct or call in the Simplex representative nearest you.

Simplex

WIRES & CABLES

SIMPLEX WIRE & CABLE CO., 79 SIDNEY ST., CAMBRIDGE 39, MASS.

Electronic Dryer Makes Better Cores and Working Conditions

POWER SALES IN INDUSTRY

The American Car and Foundry Co has installed an electronic core drying oven in its Huntington, W. Va. plant.

This dryer has many advantages, including better working conditions, better quality cores and less handling problems. Cores have a finer and more uniform finish than those baked in conventional gas or oil heated ovens.

A variable speed conveyor belt carries the cores between adjustable electrodes in an oven-type enclosure where the cores are dried. The conveyor speed ranges from 5 to 18 in. per min depending upon size of cores and moisture content of the core sand. The distance between the upper and lower electrodes is easily regulated by a hand wheel on side of oven, thus permitting continuous baking of various sized cores with practically no interruption of production.

Oven opening has been designed to take a variety of sizes and shapes of cores; with the maximum size that can be handled determined by the 12-in. by 36-in. opening. The core oven is handling approximately 600 lb of cores per hr with moisture content at 3.5%. This represents 50 lb of cores per hr above rated capacity. Average baking time for cores in oven is only 4 min.

The moisture content in a core determines the amount of electrical energy absorbed by the core while it is traveling between the electrodes, making overbaking an impossibility, further assuring high quality cores and affording little or no waste. This installation has a 15-kw dielectric heater. Power input is approximately 34 kva.

This oven has eliminated time-consuming bottlenecks by cutting the drying time of gluing and coating from hours to minutes. The gluing of the two core halves is done immediately after they emerge from the core oven. The bottoms are simply dipped into the gluing solution in the pan and the two halves are joined together and set aside to dry. Sufficient heat is retained in the cores to dry the gluing solution without the necessity of putting cores back into the oven.

The separation coating is also put on after the cores come out of the electronic oven. Again there is sufficient heat in the cores to dry the coating without putting cores back into the oven.

Because the drying oven eliminates the need for collecting racks, cooling racks and storage racks, it is a considerable space saver, since the cores may be completely handled, pasted, placed in molds and poured as they come out of the electronic core dryer. The plastic binders that are used leave the cores hard, clean and easy to handle.

DIELECTRIC SAND CORE DRYER oven cuts drying time from hours to minutes. Cores are better than those baked in conventional gas or oil heated ovens. There is much less core handling. Oven is shown at left and dielectric heater at right

No Starter or Ballast in Lighting Unit

Instant starting and elimination of starter and ballast are accomplished in a unit combination of fluorescent and incandescent lighting developed by the Philips Co of Holland. The unit consists of a 40-w fluorescent and a 68-w tungsten incandescent lamp in series. The tungsten lamp functions as a stabilizer of the arc in the fluorescent tube. The unit is designed for opera-

HOW IT WORKS

Supersonic waves are sent into the material under test. Upon reaching the other side, or upon reflection by a discontinuity, the waves return to their source and are then converted into a high-frequency potential. This potential is amplified by electronic circuits and projected upon the screen of a cathode-ray tube where they may be seen and examined.

Pulse pattern, showing the initial pattern at the extreme left and the reflection from the opposite side at the extreme right. The sweep line indicates no defects.

A typical indication of a defect is illustrated here. By means of calibration, it is now possible to determine both the exact position of the flaw, as well as its size.

Today, Supersonic testing is available on specification for inspecting Grinnell prefabricated piping. By observing the pattern produced by the electron beam on the fluorescent screen, any defects in the base metal, welds, or variations in pipe thickness can be located and measured at a glance.

Grinnell's ultra modern electronic testing can be relied upon to detect hidden flaws in pipe materials, to check unerringly the quality of welds where it picks up types of flaws not revealed by X-ray and gamma ray inspection. In examining bends, this type of testing can measure the degree to which bent pipe thins on the outside and thickens on the inside of the bend, assuring full specified thickness in high temperature, high pressure work.

Non-destructive Supersonic testing is another in a constant succession of new techniques employed by Grinnell to provide prefabricated piping which is safe and dependable . . . which measures up in every way to *rigid* state, national, association and insurance code requirements. It is another reason, too, why it will pay you to think of Grinnell "Whenever Piping Is Involved".

GRINNELL

WHENEVER PIPING IS INVOLVED

GRINNELL COMPANY, INC., Providence, R. I. Warehouses: Atlanta • Billings • Buffalo • Charlotte • Chicago
Cleveland • Cranston • Fresno • Kansas City • Houston • Long Beach • Los Angeles • Milwaukee • Minneapolis • New York
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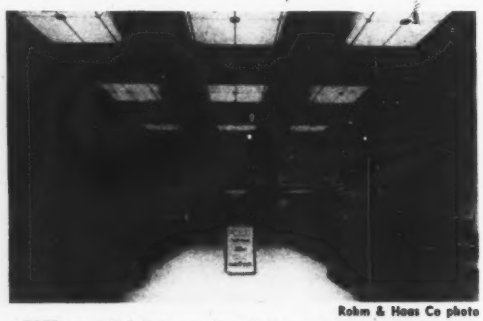
tion on 220-240 v, the voltage dividing approximately 105 v on the fluorescent and 135 on the incandescent. Output of the unit is provisionally stated as 2,800 lm, making the efficiency 26 lumens per watt, as against about 40 for the fluorescent lamp alone. The power factor is about 95% without correction.

Ignition of the unit is performed by an auxiliary electrode inside the fluorescent tube. It consists of a semi-conductive strip along the length of the tube connected to one of the arc electrodes. The end of the strip is close enough to the other electrode for ionization to occur across the gap at about 200 v and thus to initiate the arc almost immediately. The comparatively high resistance of the strip limits the required starting current to a value no higher than the operating current. Consequently it is perfectly feasible to stabilize the arc in the fluorescent tube by means of an incandescent lamp which, not being subject to voltage variation, may be calculated to yield its full light output in operation.

At present the unit is offered to the European trade in a fixture which includes two fluorescent tubes side by side with incandescent lamps at the ends, quite similar to fluorescent-incandescent combinations available in this country.

Better Lighting Ups Employee Efficiency, Improves Morale

BEFORE relighting main banking floor had average of 4 ft-c on working surfaces. Old semi-indirect fixtures of pendant type had 750-w clear lamps and luminous glass bowls



Rohm & Haas Co photo

AFTER new lighting was installed average illumination was 62 ft-c. Each fixture is 6 x 8 ft and has four corrugated diffusing plastic panels on bottom with curved plastic side panels

Since the lighting intensity in the main banking room of the Bank of Ohio in Cleveland was increased from 4 to 62 ft-c on the working surfaces, the employees have become more alert in their business habits, more cheerful and more efficient. This is the opinion of Harry Small, executive vice-president of the bank who also states that the over-all effect of the new lighting system is outstanding.

No Wattage Increase

It is significant to note that this increased intensity was effected with practically no increase in over-all wattage of the system.

The new system consists of 12 specially-built fixtures—approximately 6 x 8 ft in size and having 4 corrugated diffusing plastic panels on the bottom with curved side panels formed from 12-in. wide strips of flat plastic material. The plastic material is translucent white, 0.125 in. thick.

Each fixture is equipped with 10 96-in. 300-ma slimline lamps and two 40-w standard fluorescent lamps at the ends of the slimlines and at right angles to them. These fixtures are mounted on an 18-ft ceiling. Lamps of 3,000 K are used throughout. The lighting intensity averages 67 ft-c on the working surfaces.

The old fixtures in the main banking room were semi-indirect pendant type having luminous glass bowls—each with a 750-w clear incandescent lamp. The average working level intensity was 4 ft-c.

75 Ft-c in Director's Room

New plastic fixtures, similar to those in the main banking room were installed in the director's room. These produced an average illumination of 75 ft-c on the conference table, using the same number and type of lamps.

In preparing the recommendations for this lighting installation, the Cleveland Electric Illuminating Co's commercial sales dept cooperated with John Liston, fixture designer, commissioned by George S. Rider Co, Architects. Installation was made by Cleveland Electric Illuminating Co.

Load Building Notes

• Denver, one of the first cities to use mercury street lights, is buying 289 more of them. They will light 2.1 miles of the 12-mile stretch of the new Colorado Valley Highway that lies within the city limits. The luminaries are the first group of the 1,800 total required. Horizontal type, they will be stagger-spaced 90 ft apart, 30 ft above the pavement on 15-ft brackets.

• Annual cooperative fall lighting campaign sponsored by the Electrical Association, held in Philadelphia, is being concentrated on industrial, commercial and exterior lighting. There was a contractor prize contest with $700 in awards varying from $75 to $12.50 for jobs installed.

BURNDY- BUILT *to do an important job* BETTER

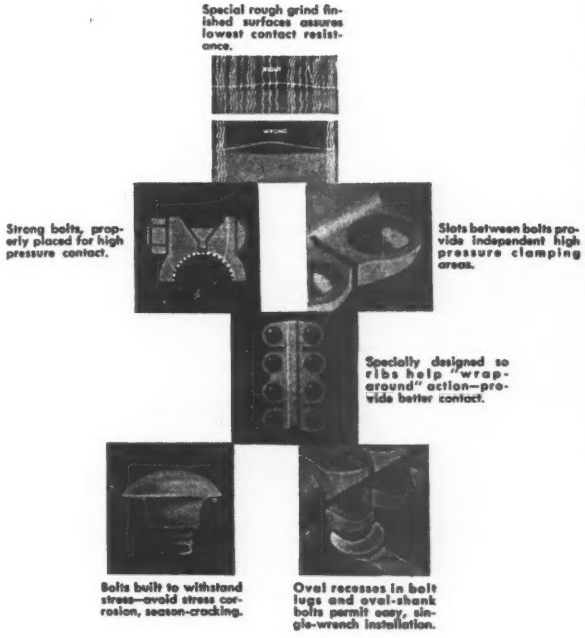
BURNDY POWER CONNECTORS

Safeguarding the service continuity of your system is an important job and one that starts at the point of connection in the substation.

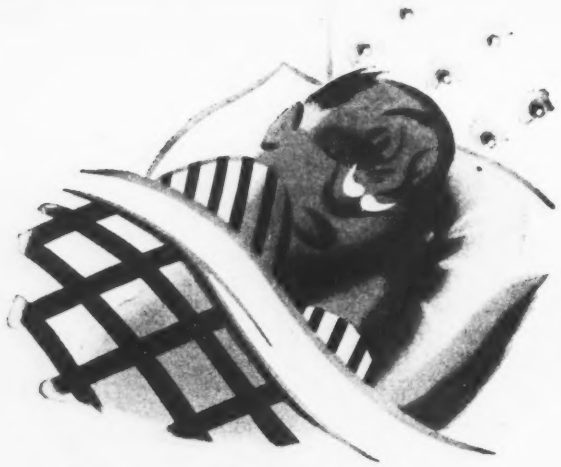
Burndy Power Connectors are engineered completely to meet all the requirements of substation service. The Burndy line is *complete*—over 140 standard types can be supplied for your connection needs on cable, tube, bar and special shapes—on copper and aluminum conductors.

Write for Catalog 50, or for prompt personal assistance ask for the Burndy Representative.

BURNDY
POWER CONNECTORS


Special rough grind finished surfaces assures lowest contact resistance.
Streng bolts, properly placed for high pressure contact.
Slots between bolts provide independent high pressure clamping areas.
Specially designed so ribs help "wrap-around" action—provide better contact.
Bolts built to withstand stress—avoid stress corrosion, season-cracking.
Oval recesses in bolt lugs and oval-shank bolts permit easy, single-wrench installation.

21 *Burndy Engineering Co., Inc., New York 54, N. Y. • Western Branch: Vernon 58, Calif. • Burndy Canada Ltd., Toronto 8, Ontario*



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Further, when a C-O-TWO Smoke or Heat Fire Detecting System is used in combination with a C-O-TWO Low Pressure Carbon Dioxide Type Fire Extinguishing System, the first trace of smoke or spark of fire in a protected area immediately sounds an alarm . . . then the fire quenching carbon dioxide is readily released into the threatened area.

So, whatever your fire protection problem, let an expert C-O-TWO Fire Protection Engineer help you in planning complete and up-to-date fire protection facilities now. Write us today . . . tell us about your particular fire hazards, our experience is at your disposal . . . no obligation of course.

C-O-TWO

C-O-TWO FIRE EQUIPMENT COMPANY

NEWARK 1 • NEW JERSEY

Sales and Service in the Principal Cities of United States and Canada

Affiliated with Pyrene Manufacturing Company

MANUFACTURERS OF APPROVED FIRE PROTECTION EQUIPMENT

Squeez-Grip Carbon Dioxide Type Fire Extinguishers • Dry Chemical Type Fire Extinguishers

Built-In High Pressure and Low Pressure Carbon Dioxide Type Fire Extinguishing Systems

Built-In Smoke and Heat Fire Detecting Systems

INDUSTRIAL BRIEFS

Recap Mold is heated electrically to curing temperature in only 30 min by Donald MacMillan of Macon, Ga. With this electric mold, any tire can be top-capped or full treaded with only three patterns. Thermostatically controlled, the unit assures even and constant temperature at all points on tire. Mold operator has to perform only one manual operation during entire process due to electrically-driven air pressure. Automatic side plates allow oversize and undersize tires to be cured without costly measuring.—Industrial Power Div, Georgia Power Co.

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Power Distribution Needs at Macy's Department Store in San Francisco were filled with metal enclosed dead front low-voltage switchgear. Adequate feeder and branch circuit capacity eliminates power outages and potential fire hazards. Flexibility of this type equipment permits load changes and expansion without extensive changes in switchgear.

YOU CAN BE **SURE**.. IF IT'S

Westinghouse

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J-04276

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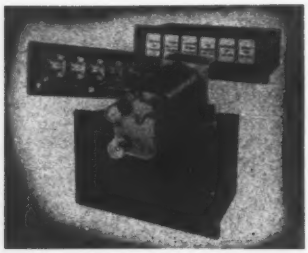

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Square D Co, 6060 Rivard St, Detroit 11, Mich.

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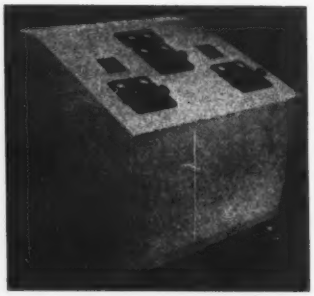

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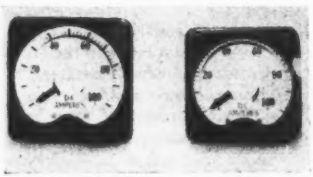

Switchboard Instruments

A new concept in dial and cover structure is featured in the new Full-View Type K-24 circular scale switch-

Extra strength ... for *Extra* length

HUBBARD TRUSS TYPE
UPSWEEP MAST ARM

CHECK THESE ADVANTAGES

- ✓ Exceptional strength . . . four-way triangular truss arrangement.
- ✓ Require small pole mounting space.
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HUBBARD AND COMPANY

ESTABLISHED 1843

PITTSBURGH • CHICAGO • OAKLAND, CALIFORNIA

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board instruments. Maximum readability is claimed to be provided from the steepest angles, with no objectionable shadows on the scale. Cover of this instrument is about ⅜-in. wider and higher than the original Type K-24. By replacing dials and covers, these older types can be converted to Full-View.

Westinghouse Electric Corp, P. O. Box 2099, Pittsburgh 30, Pa.

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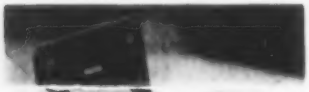

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C-O-TWO

C-O-TWO FIRE EQUIPMENT COMPANY

NEWARK 1 • NEW JERSEY

Sales and Service in the Principal Cities of United States and Canada

Affiliated with Pyrene Manufacturing Company

MANUFACTURERS OF APPROVED FIRE PROTECTION EQUIPMENT

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J-04276

Westinghouse

PLANNED LIGHTING SYSTEMS

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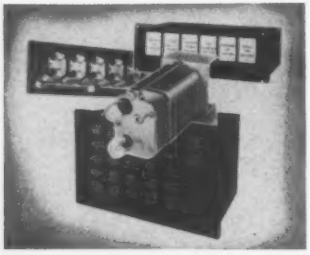

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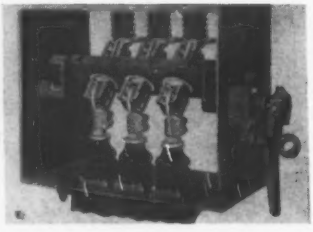

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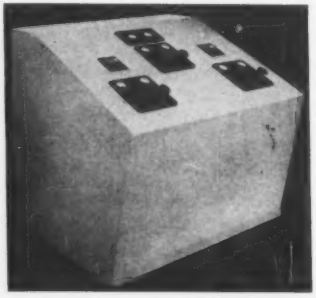

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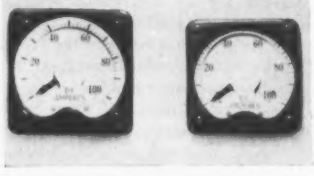

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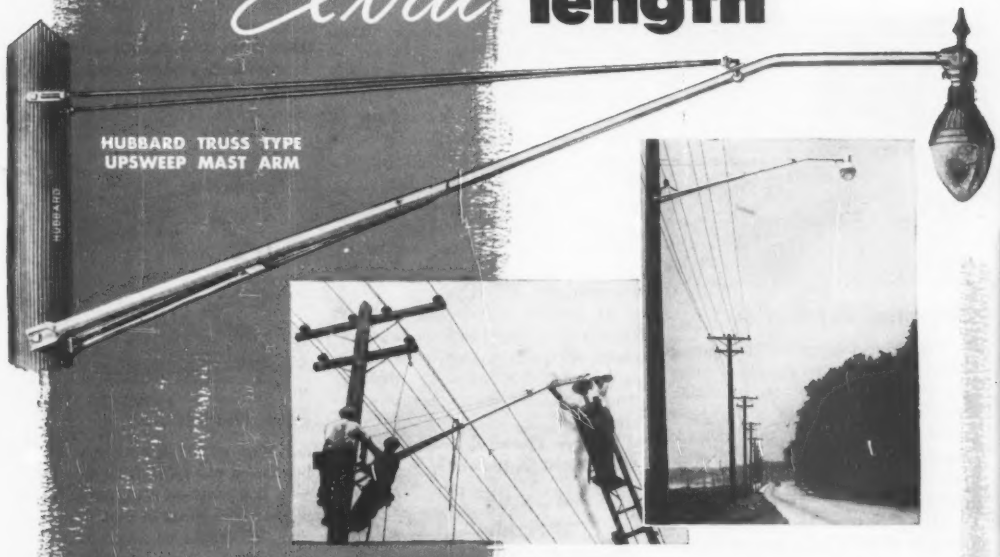

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HUBBARD AND COMPANY

ESTABLISHED 1843

PITTSBURGH • CHICAGO • OAKLAND, CALIFORNIA

"Hang the Load on Hubbard Hardware!"

board instruments. Maximum readability is claimed to be provided from the steepest angles, with no objectionable shadows on the scale. Cover of this instrument is about ⅜-in. wider and higher than the original Type K-24. By replacing dials and covers, these older types can be converted to Full-View.

Westinghouse Electric Corp, P. O. Box 2099, Pittsburgh 30, Pa.

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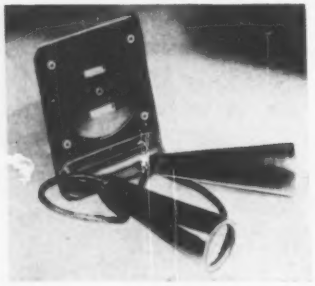

Potential Tap Device

Voltage measurements can be made across a load without the usual "breaking in" on the line by use of the No. 400PT. It consists of a wafer-thin plate which slips over the prongs of standard Edison plugs and provides two tip jacks that receive standard phone tips.

The appliance to be checked is plugged through the potential tap into the power receptacle. A voltmeter with phone-tip leads may be used to check the voltage with the appliance on or off. In this manner the voltage drop with load on may be read without removing plug from the line and wiring in the instrument.

Industrial Devices, Inc, Edgewater, N. J.

•

Power Tester

Prevention of power losses and detection of overloads and defective equipment is ascribed to the Model 188 electrical power analyzer. The equipment gives measurements of volts, amperes, watts, reactive kva, and phase rotation indication. Megohm scale for insulation testing is from 0-200. Measurements as low as 0.1 ohm can be made on the 0-200 ohm scale.

Flexible switching permits voltage measurements across any phases of a

single-, two-, or three-phase circuit, and current measurements in any of the lines. Power factor is ascertained from the kvar value.

Polyphase current transformer is the tapped primary type with overlapping ranges of 1.5-5-15-150-300. Instrument elements for ac measurements are all electrodynamometer or moving coil type. Multipliers, depending on taps selected, can be applied to the 0-5 amp scale and 0-1 kw scale.

All necessary connecting leads are furnished, equipped with special color-coded terminals. Also included are test report forms and motor efficiency data packed in the leather case included.

Niagara Electrical Instrument Co, 559, Ellicott St, Buffalo 3, N. Y.

•

Proportioning Controller

Accurate control of temperatures on the following electrically heated industrial equipment is claimed for Series 4700 electronic input controller: Furnaces, ovens, pots, melters, roasters, press platens, heaters, driers, kilns, and kettles. Based on rate of charge and discharge of a capacitor, the control enables the user to "line-out" without undue overshoot. Ability to operate with a proportional band as narrow as 2% eliminates set point shift with varied load changes.

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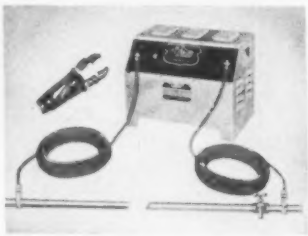

Pipe Thawer

Frozen water pipes reportedly may be thawed out in a matter of minutes with Therm-o-tron equipment. It may be used with pipes of iron, copper, or lead. Its use for heating, brazing, and soldering is also suggested by the manufacturer.

To put the thawer into operation, it is carried to the job, plugged into a 110-220-v, 50/60-cycle outlet, pipe clamps are attached, and power turned on. Two heat control taps range from 200 to 500 amps. Each tap automatically regulates the proper amount of current and voltage required for various sizes and lengths of pipe. Equipment includes 40 ft of heavy duty secondary output cable, two pipe clamps, 10 ft of power cord with plug.

Trindl Products, Ltd, Therm-o-tron Div, 17 E. 23rd St, Chicago 16, Ill.

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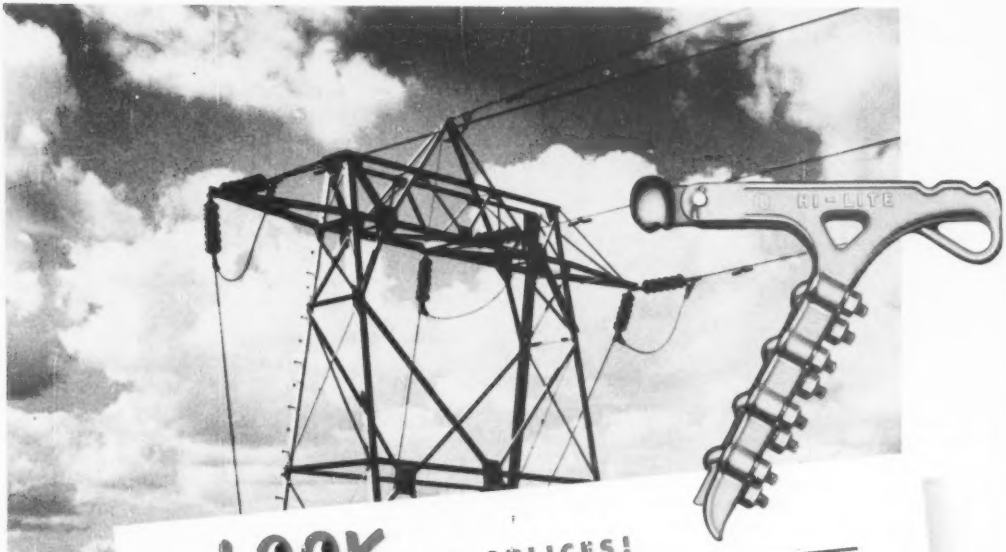
Slide Grip F-Lamp Hanger

One-man installation of fluorescent Trimline lighting fixtures is reported possible with a "Quick Grip" slide hanger. Hanger permits support of the fixture at almost any convenient posi-

(*Continued on page* 95)

HI-TENSION NEWS *Junior*



LOOK NO SPLICES!

Look closely at the jumpers on this strain tower . . . No splices! Conductor cable runs straight through without resorting to parallel jaw clamps to carry current and, eventually, to make trouble.

Construction like this is possible with O-B Hi-Lite strain clamps. It's easy to build, easy to inspect for soundness at any time, easy to keep in top condition. No special equipment, tools, or skills are required to install O-B Hi-Lites. A minute or two with a standard wrench and they're ready to serve the life of the line. Basically low in first cost, the O-B Hi-Lite installs at an attractive over-all saving.

Just add up these factors: Design that permits the use of continuous jumpers -- convenience -- high maintained holding power -- positive inspection for soundness at any time -- low installed cost -- availability in either ferrous or non-magnetic, non-heating alloys. Don't you agree it's worth your time to investigate O-B Hi-Lite strain clamps?

Ohio Brass

MANSFIELD, OHIO, U. S. A.

HI-TENSION NEWS *Junior*

Close Tolerance

Gives You More For Your Money in Lightning Arresters

True apparatus protection is not measured by taking figures from a lightning arrester tabulation showing *average* sparkover and IR discharge ratings. These averages must be modified by tolerance. Every per cent of tolerance added to the average rating robs just that much from the vital protective margin between insulation strength of the apparatus and performance of the arrester.

Pay special attention to the tolerance offered in O-B Thorex lightning arresters -- *less than* +10% sparkover and *less than* +5% IR discharge. These are the lowest ever seen on the American market. They leave you wider protective margins; give you more of the only thing an arrester has to offer -- apparatus protection!

FORGET IT!

—That's What They've Done With this O-B Insulation for 30 Years

Built in 1913, connecting a sizable nearby city to a metropolitan system, this O-B insulated line is in its 38th year of service. Even with modern stepped-up requirements, the line is good from every standpoint.

If you want this kind of performance from *your* insulation -- if you'd like to put it up and just forget it -- mark your next insulator requisition "O-B."

Two Days

You Can Well Afford to Consider When You Buy Station Insulators

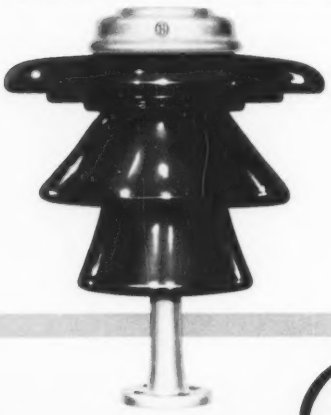
IMPROVED

Tie Connection Makes O-B Pin Insulators Still Better

Put the O-B Clamptop on either a post or conventional pintype insulator and what do you get . . . Elimination of one of the chief causes of radio noise . . . A tie connection that can't be duplicated for strength or durability by any hand-served attachment . . . Low construction cost due to appreciable pole-top time saving . . .

No need for special skill -- the O-B Clamptop attaches with two common hex nuts . . . The safest hot-working insulator made, according to many power company users.

It will pay you to investigate O-B pintypes or posts equipped with the handy Clamptop.



Specifications and standards ruling station insulator design apply only in the "as manufactured" condition. In other words, they relate to the insulator's *first day* of life. Performance is measured after long service, on the insulator's *last day*. Don't confuse these two days -- it may cost you money!

O-B's greatest bid for your station insulator business is based on keeping that last day from arriving too soon. In hundreds of cases, it's still out of sight after 30 years or more.

On the first day they all look alike. But if you buy your station insulators with the *last day* in mind, there is ample recorded evidence to back your choice of O-B.

Ohio Brass

MANSFIELD, OHIO, U.S.A.

HI-TENSION NEWS *Junior*

You have to fit the FUTURE

How tight are your "distribution pants?" Can you grow into a residential power demand of 5000 kwhr per year -- the average load expected by 1960 -- without splitting them?

Many companies, with an eye to the future, are preparing their systems by rebuilding low voltage primary deadends *now* for an inevitable voltage increase. A standard assembly, consisting of two O-B suspension insulators and a Universal Strain Clamp will put extra room for growth in your "distribution pants" so that when tomorrow comes, a major item of preparation will be ready.

Ohio Brass

MANSFIELD • OHIO

4108-H

New Equipment

(*Continued from page* 90)

tion on the ceiling, as determined by ceiling supports, desired symmetry of stems, or location of wiring outlets.

After the hanger is fastened on a stem or directly to the ceiling, the fluorescent fixture is brought up into the slide grip whose width is such that its lips automatically hold the fixture firmly in place. Eliminating any chance of dislodging the fixture is a locking screw which is placed through the hanger above the fixture.

Sylvania Electric Products Inc, 60 Boston St, Salem, Mass.

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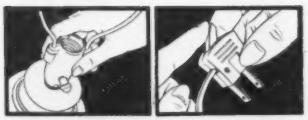

Lamp Wiring Kit

Ordinary table lamps can be converted for the new GE white indirect 3-lite bulb by the Improv-a-Lite lamp wiring kit. Used with the kit, the bulb lights to 150 w brightness first, then 100, then 50 w.

Kit consists of a factory-wired three-way socket, new wide harp, 8-ft cord, and a clamp-on plug. After removing old wiring from the lamp, thread new cord through lamp and screw on three-way switch as in illustration at left, then clamp on the plug (right drawing).

Monowatt, Inc, Providence 7, R. I.

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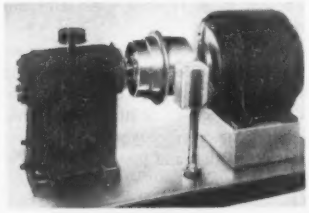

Cut-Out Couplings

Power to machine tools, processing equipment, conveyors, etc, is reported to be instantly shut off by an automatic device should an over-load occur. This prevents sheared pins and the time needed to replace them. The cut-out coupling resets itself automatically.

Features of a flexible coupling and the torque-sensitive protection of the company's present cut-out pulley are said to be combined in the new coupling. They are furnished in two sizes, with working ranges from 10, to 2,000 in.-lb torque. Catalog 50A gives applications and a description.

Anchor Steel & Conveyor Co, 6906 Kingsley Ave, Dearborn, Mich.

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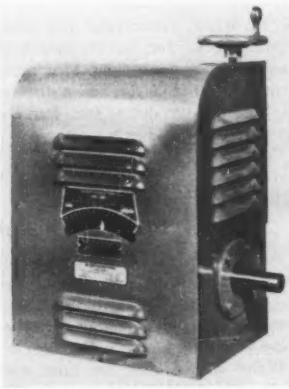


Variable Speed Drive

Six models comprise a new variable speed transmission series, known as the Allspeed Drive. Due to the tandem belt design, this drive is said to be particularly suited where space limitations require extreme compactness. The units can be furnished for vertical or horizontal operation, to run in either direction. Handwheel control is normally furnished; electrical remote controls are available.

The six models are rated at 1, 3, 4, 7½, 10 and 15 hp, offering variations of 16:1, 10:1, 9:1, 8:1, 6:1 and 6:1, respectively. They may be ordered as a packaged unit with NEMA standard motors.

Worthington Pump and Machinery Corp, Allspeed Drive Div, Holyoke, Mass.

MORE NEW PRODUCTS
about which you should know

The Thompson Electric Co, 1101-14 Power Ave, Cleveland 14, Ohio, has announced a new **suspension yoke** assembly that supports two pendant-type lights in industrial plants and other structures using high-level lighting systems. . . . National Electric Products Corp, Chamber of Commerce Bldg, Pittsburgh 30, Pa., has developed a flexible electrical **conduit** that uses Fiberglas and special construction to reduce the metal use. It is petroleum-resistant and intended for HF currents as in radar, or for automotive radio insulation.

W. H. Brady Co, 1615 Spring St, Chippewa Falls, Wis., offers Quik-Label **colored wire markers** said to stick permanently to wire without moistening; reported to make possible buying of wire in only one color. . . . Panellit, Inc, 7218 N. Clark St, Chicago 26, Ill., has developed an **interlock receptacle** with automatic circuit breaker for hazardous locations; receptacle capacities to 20 amp.

The Miller Co, Meriden, Conn., is marketing its Hartford **fluorescent luminaire** in combination with the Patternizer fitting. Available for general and slimline fluorescent lamps in 4, 6, and 8-ft lengths; details are in a new catalog. . . . Sterling Electric Motors, Inc, Telegraph Rd at Atlantic Blvd, Los Angeles 22, Cal., has announced its Speed-Trol **motors** can now be had in single-phase capacitor-type design from ½ to 3 hp, 2:1, 3:1, or 4:1 speed variations.

Nickel Cadmium Battery Corp, Easthampton, Mass., has designed a T-Type nickel cadmium alkaline **battery** especially for starting railroad diesel engines. . . . Essex Wire Corp, R-B-M Div, Logansport, Ind., offers Series 97000 **relay** reported to have higher contact pressure and more coil power for applications where shock and vibration are encountered. . . . H. K. Porter, Inc, Somerville, Mass., has a hand tool called the Impakdriver for tightening or **loosening screws,** bolts or nuts; useful where bolts are rusted or frozen.

General Electric Co, Schenectady 5, N. Y., has a redesigned line of thermocouple **vacuum gages** for industrial laboratory and other applications where vacuum must be measured in the 0-200 micron range. . . . Universal Gear Corp, 19th and Martindale, Indianapolis 7, Ind., is making Model 5-E **speed reducer** for applications in the ¼ to 1 hp range.

NEWS ABOUT PEOPLE

Fuller Named President of Shawinigan W&P Co

J. A. Fuller, executive vice president of Shawinigan Water & Power Co, Montreal, has been elected president. He succeeds James K. Wilson, retiring because of ill health after 11 years as president.

J. A. FULLER

Fuller has been executive vice president since early last year and a vice president since 1947. He was appointed assistant to the president in 1945. At the same time he became vice president of Shawinigan Chemicals, Ltd, of which he had been secretary-treasurer.

Wilson worked for Canadian Fairbanks-Morse Co and Barrett Roofing Co before joining Shawinigan in 1928 as merchandising manager in the commercial and distribution department. He was president of the Canadian Electrical Association 1945-46.

•

E. G. Nielsen, planning engineer of the Bureau of Reclamation's Region III since 1945, has been appointed assistant director of the region. He succeeds L. R. Douglass, who was named director of power for Boulder Canyon Project. Nielsen joined the chief engineer's staff in the Bureau's office as a designer in 1934 and went into project planning two years later. He was in charge of the planning office at Salt Lake City and later headed the hydrology division in Denver. Before going to the Bureau he worked at the Keokuk, Iowa, hydroelectric station, for Stone & Webster Engineering Corp, and with the Missouri Public Service Commission.

G. M. Ruoff, commercial vice president of Locke, Inc, has resigned from that company to become vice president, general manager, and a director of Porcelain Products, Inc, Parkersburg, W. Va.

•

Duncan Electric Elects Jack Bixler President

Jack Bixler is now president of Duncan Electric Manufacturing Co, Lafayette, Ind. Fred Holmes, president for the past 21 years, has become chairman of the board.

Bixler started with the sales staff of Duncan in 1924. He was promoted to sales manager in 1929 and three years later became treasurer. He served as vice president in charge of sales from 1939 to 1948 and has been executive vice president for the past two years.

Holmes joined the company in 1914. He has held the positions of secretary, vice president, and president.

George Oliver, assistant treasurer, was named treasurer.

•

G. Carlisle Tippit, manager of the order and planning department of Reliance Electric & Engineering Co, has been appointed general purchasing agent. Walter H. Behnke, a member of Reliance's applied engineering department since 1945, will succeed Tippit. Tippit joined Reliance in 1945 and has headed the order department since 1948.

William F. Thiele, executive vice president of Wisconsin River Power Co, has been elected president. He succeeds George W. Mead, who has resigned because of ill health. The company operates hydroelectric plants at Petenwell and Castle Rock on the Wisconsin River.

Auchy New Chairman of Interstate Power Club

Frank Auchy, of the industrial power sales department of Philadelphia Electric Co, has been elected chairman of the Interstate Power Club of New York. He succeeds John B. Taylor, assistant vice president of Atlantic City (N. J.) Electric Co.

FRANK AUCHY

New vice chairman of the organization is S. L. Chapin, Public Service Electric & Gas Co. W. P. Graham, Philadelphia Electric, was named secretary-treasurer. Directors are Taylor; Justin H. Ahrens, Hartford Electric Light Co; Thomas C. Roe, Delaware Power & Light Co; Fred I. Smith, Jersey Central Power & Light Co; and E. B. Haskell, United Illuminating Co.

Auchy has spent his entire business life in the electrical field, including contracting, lighting equipment design, and sales. With Philadelphia Electric he has been in lighting sales and promotion and power sales.

•

Jerome S. Katzin, who for the past year has been executive assistant to Securities and Exchange Commission Chairman Harry A. McDonald, has been appointed associate director of the commission's Division of Public Utilities. He succeeds Maurice C. Kaplan, who has resigned after more than 12 years with the division. Katzin

ELECTRICAL INSULATION IS OUR SPECIALTY

Q. *What ONE wire and cable producer grows its own natural rubber, and makes its own synthetic rubber?*

A. UNITED STATES RUBBER COMPANY.

Q. *What ONE wire and cable producer makes plastics?*

A. "U. S."

Q. *What is the most important part of wire and cable?*

A. The insulation.

Q. *Who is best equipped to make wire and cable with superior insulation?*

A. U. S. RUBBER—which grows its own natural rubber, makes its own synthetic rubber, manufactures its own plastics.

Working with a valuable and rare electron-microscope in the laboratories of the United States Rubber Company. This microscope magnifies 100,000 times. The technician is examining compounding ingredients, one of the many steps taken to insure the finest insulation possible.

Isn't it logical that a rubber company should make the best wire and cable insulation there is? U. S. Rubber has been a pioneer in insulation for over 70 years—has amassed in that time a stockpile of research data and experience that can't be beat. Electrical insulation is a "U. S." specialty!

Electrical insulation makes the difference between superior and ordinary wire and cable. Conductors of all manufacturers are standard, but insulation must be the best that science can produce. That's why your best bet in wire and cable is U. S. Rubber.

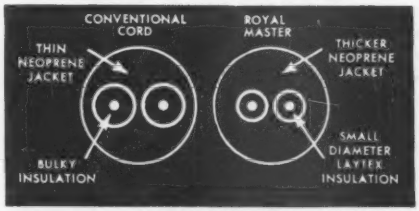
SOME MORE OF THE MANY DIFFERENT VARIETIES OF "U. S." WIRE AND CABLE

UTILITIES: Power Cables • Street Lighting • Royal Cords • Network Cables • Utility Control • Pole & Bracket Cable • Service Entrance • Weatherproof • Zip Cord Pole Fixture Cable • Sup. Control

RAILROADS: Power Cables • Communications • Railway Signal • Royal Cords • Welding Cable • Railway Utility • Sup. Control • Weatherproof

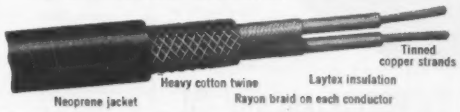
HEAVY INDUSTRY: Power Cable • Royal Cords • Welding Cables • Control Cables • Machine Tool Wire • Building Wire • Switchboard Wire • Thermostat Cable • Bus Drop Cable

ONLY
U. S. ROYAL MASTER PORTABLE CORDS
PROVIDE
DOUBLE PROTECTION
WHERE NEEDED MOST



For trouble-free, long-life service under very severe conditions, the small diameter of Laytex insulation permits a neoprene jacket of almost double the thickness of the jacket on ordinary heavy-duty cords—thus providing double protection where it's needed most. Rayon braids cover the Laytex insulation for added protection at terminals and for color-coding. Made only by U. S. Rubber, Royal Master Cords are the world's best heavy-duty portable cords.

Available in sizes 18 to 10 AWG, in 2, 3 and 4-conductor assemblies. Known as Type SUO by the National Electrical Code and Underwriters' Laboratories.



U.S.RUBBER
SERVING THROUGH SCIENCE

UNITED STATES RUBBER COMPANY
ELECTRICAL WIRE & CABLE DEPT. • ROCKEFELLER CENTER, NEW YORK 20, N.Y.

EVERSTICK ANCHORS...

FIRST CHOICE for

- PERMANENCE
- HOLDING POWER
- LONG LIFE
- SAFETY

They speed up work and provide dependable anchorage in new construction and maintenance. Quick and easy to install — made of tough rust-resistant malleable iron — their holding power "tops" all others. Available two-way, three-way, four-way and cone types. Write for facts.

Exclusive Everstick nut housing. Locks anchor firmly on rod. No chance of rod slipping thru anchor.

EVERSTICK ANCHOR CO.
Manufacturer of
"THE ANCHOR OF MERIT"
FAIRFIELD, IOWA

has been with SEC in various legal positions since 1941. **Myron S. Isaacs** succeeds Harry G. Slater, resigned, as chief counsel of the division. Isaacs joined the division's staff in 1942 and recently was made assistant director of the division.

•

Eckel Heads GE Division; Other Promotions Made

Joseph F. Eckel, manager of General Electric Co's River Works at Lynn, Mass., since 1947, has been appointed manager of the Large Motor and Generator Divisions at Schenectady, N. Y.

He succeeds J. M. Crawford, now manager of the Transformer and Allied Product Divisions at Pittsfield, Mass. Herbert L. Ross, who has been manager of manufacturing of the Meter and Instrument Divisions, will replace Eckel as River Works manager. Ross's post will be taken over by Henry A. Vaughn, superintendent of the Specialty and Standard Instrument Manufacturing Divisions.

Eckel joined GE in 1918 as a member of the cost accounting division at Schenectady. He was in charge of the cost accounting section of the refrigerator division in 1935 when he was named assistant coordinator of the manufacturing division for all GE plants. Four years later he was made coordinator. In 1942 he became coordinator of supercharger manufacturing in all GE plants. In 1945 he was transferred to the Lynn River Works as assistant manager and became manager two years later.

Ross started with GE in 1924 as an apprentice at Lynn River Works. Later he was in charge of material utilization, directed the manufacturing methods department and the model shop, and was assistant mechanical superintendent and operated the Demand Meter Division at the West Lynn Works. In 1941 he was named superintendent in charge of turbosupercharger manufacturing at Everett, Mass. He returned to West Lynn as general superintendent in 1945 and was made manager of manufacturing of the Meter and Instrument Divisions in 1947.

Vaughn joined GE in 1922 as a tester in the West Lynn Works Laboratory. Later he was a checker and time-study man and eventually was put in charge of such activities. Since 1931 he has been in charge of the manufacturing of instruments.

•

Frederick A. Rose has joined Porcelain Products, Inc, at its Parkersburg, W. Va., plant as manager of manufacturing. Rose has been in porcelain manufacturing since 1922 and since 1937 has been with subsidiaries of General Electric Co. He was manufacturing engineer at the Trenton, N. J., plant of Trumbull Electric Manufacturing Co before going to Locke, Inc, Baltimore, in 1942. At Locke he set up manufacturing operations for special types of insulators for war requirements, was chief methods engineer, and since 1945 has been manufacturing engineer. He received GE's Coffin Award for the designing and building of automatic machines for the production of various types of high voltage insulators.

William W. Perry, chief engineer of New York State Electric & Gas Corp, Binghamton, N. Y., is retiring after 26 years with the company. He has been in public utility work in New York and Pennsylvania for 27 years. In 1935 he became resident engineer for Gilbert Associates, Inc., consulting engineers on construction for New York State E&G. He was appointed chief electrical engineer of the utility in 1938 and became chief engineer in 1940.

J. J. Mitchell, vice president of Bull-Dog Electric Products Co, Detroit, is retiring. Mitchell joined the company in 1934 as a sales specialist. He reorganized the sales department and established national distribution of the firm's products. He was made sales manager in 1935, vice president in charge of sales in 1939, and vice president serving as administrative assistant to the president in 1949.

Earl J. Biegel, assistant superintendent of electric distribution for the Memphis (Tenn.) Light, Gas & Water Division, has left for Salonika, Greece, where he will work as an electrical engineer for Ebasco Services, Inc, in its project of rebuilding Greece's power system. Biegel returned to Memphis a year ago from Korea, where he spent 13 months with the South Korean Power Commission, an American-sponsored agency. He had been with the Memphis utility since 1927.

Check These Features and You'll Choose VICTOR SWITCH and BUS INSULATORS

Do You Know that...

Victor maintains a modern, fully-equipped ceramic laboratory where fundamental and applied research as well as control tests on raw materials and processing are continually carried on? Small wonder Victor Insulators are famous for performance and economy!

V ALL METAL PARTS are hot-dipped galvanized to assure maximum resistance to weathering and corrosion.

V CONTROLLED TESTING and PROCESSING of cement assure high bond strength at all assembly joints.

V SMOOTH, HARD GLAZE assists self-cleaning process, thus reducing maintenance and replacement costs, especially in contaminated areas.

V SERVICE-TESTED DESIGN provides for maximum flash-over performance and long leakage distance.

V HIGHEST QUALITY WET PROCESS PORCELAIN—"tops" in dielectric and mechanical strength.

V RUGGED, THICK CORRUGATIONS and smooth, rounded edges give maximum resistance to impact.

V RESILIENT COATINGS at all cemented joints give maximum resistance to thermal variations and mechanical shocks.

VICTOR NO. 742 (TR-No. 7) SWITCH and BUS INSULATOR. For complete engineering data on this and other sizes and types of switch and bus units, write today for Victor's complete catalog.

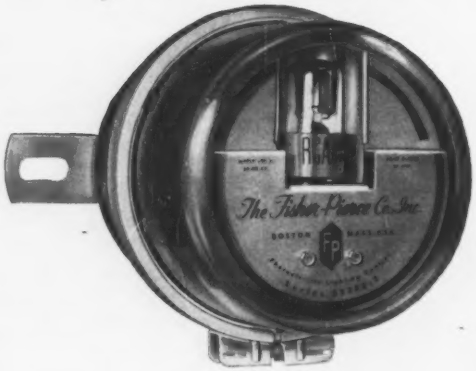
Specify

VICTOR SWITCH and BUS INSULATORS

Victor Switch and Bus Insulators are preferred by power men because every component is designed to combine maximum resistance to flashover with maximum mechanical strength. To guarantee "on-the-job" dependability, each insulator is individually tested at every point of manufacture.

VICTOR INSULATORS, INC.
VICTOR, N. Y.

Improved....



Series 63300 B

FISHER-PIERCE

PHOTOELECTRIC CONTROL

FOR STREET LIGHTING

This new Fisher-Pierce Control is the result of long experience in design and manufacture, combined with practical experience of more than 600 electric utilities in more than 20,000 installations.

The new 63300 B Control is mechanically and electrically interchangeable with existing controls. The same dependable Fisher-Pierce circuit, consistently giving tube life of more than 20,000 hours, has been retained. Improved spacing and insulation provides increased protection against lightning damage . . . up to 2500 volts rms Hipot. Mechanical design has been altered to provide maximum simplicity for greater economy of servicing.

Fp

The FISHER-PIERCE Co., Inc.

82 CEYLON STREET, BOSTON 21, MASS.

OBITUARY

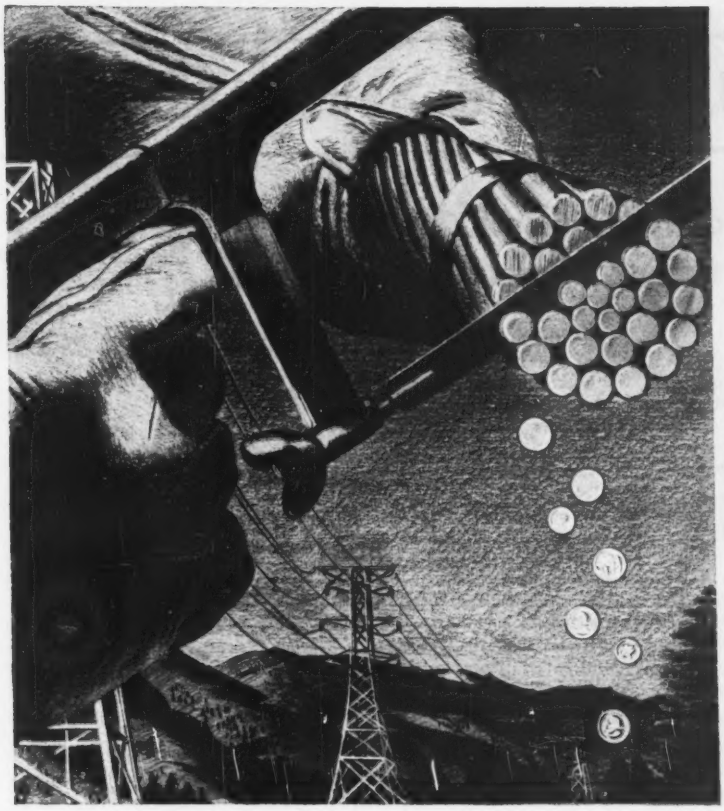
Arthur V. White, 74, Canadian consulting engineer, died Dec 7 in Toronto. From 1921 until his retirement in 1934 he was consulting engineer with the Ontario Hydro-Electric Power Commission, and he represented the Canadian federal government in internation discussions of such matters as the St. Lawrence Seaway, the Chicago drainage canal, Niagara Falls power, export of electricity, and water power of Nova Scotia, New Brunswick, Ontario, and British Columbia. He had made a special study of the export of Niagara power and its relationship to coal supply. Before joining the hydro commission he served as chief draftsman for Canadian General Electric Co in Peterboro and as an engineering expert with Brown Brothers, London, England.

Col Frank H. Forney, an Army Corps of Engineers officer who had held several civil works posts, was killed in action during the Han River offensive in Korea on Nov. 29. Forney, a Corps officer for 21 years, was district engineer at Buffalo, N. Y., when he was transferred to command of an engineer combat unit last July. He had been chief of the repairs and utilities division, military construction, Office of the Chief of Engineers, from 1947 to 1949, and had seen active duty overseas in World War II.

Martin Port Rice, retired director of General Electric Co's publications bureau, died at his home in Schenectady, N. Y., Dec. 18. He had been ill since May. Rice headed the GE bureau from its organization in 1897 until his retirement in 1932. He also was manager of broadcasting and in that capacity supervised the opening and operation of Radio Stations WGY in Schenectady, KGO in Oakland, Calif., and KOA in Denver.

Robert M. Turner, 53, San Angelo, Texas, manager for West Texas Utilities Co, died Dec 11. He had been with the company since 1928.

Charles A. Light, 71, former chief engineer of Oklahoma Gas & Electric Co, died recently at his home in Oklahoma City. He was with OG&E from 1905 until his retirement in 1944.



How to cut out dollars

By using *aluminum* electrical conductor you can cut dollars from your costs in two ways:

1. **ACSR costs less than copper.**
2. **Light weight of aluminum cuts installation costs.**

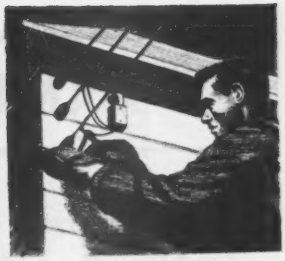
These facts have been proved so conclusively that today more than 80 per cent of all transmission line being installed is aluminum.

Today more and more of these installations are being made with Kaiser Aluminum electrical conductor. For, as a major supplier to the electrical industry, Kaiser Aluminum has built a reputation for quality and service that is unsurpassed.

• • •

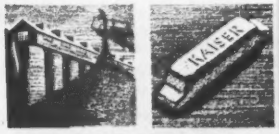
To help meet critical military needs, Kaiser Aluminum has begun a vast expansion program which will greatly increase production of primary aluminum. When conditions permit, this aluminum will be shared by manufacturers of civilian goods.

Meanwhile, if you have any electrical conductor problems, call any office below.



MORE SAVINGS . . . with Kaiser Aluminum weatherproof wire, polyethylene or neoprene covered. Costs much less than copper, saves money on installation.

HIGHEST QUALITY . . . the result of Kaiser Aluminum's experienced personnel using the finest production facilities and the most modern testing instruments.



DEPENDABILITY . . . because *all* of Kaiser Aluminum's production facilities—from bauxite processing to finished ACSR—are completely integrated.

PROMPT DELIVERY . . . quick access to service personnel . . . because of Kaiser Aluminum's convenient location at Newark, Ohio.

Kaiser Aluminum

Setting the pace . . . through quality and service

SOLD BY KAISER ALUMINUM & CHEMICAL SALES, INC., KAISER BUILDING, OAKLAND 12, CALIFORNIA

OFFICES IN: Atlanta • Boston • Chicago • Cincinnati • Cleveland • Dallas • Denver • Detroit Houston • Indianapolis • Kansas City • Los Angeles • Milwaukee • Minneapolis • New York Oakland • Philadelphia • Portland, Ore. • Rochester, N. Y. • Seattle • Spokane • St. Louis Wichita • EXPORT OFFICE, OAKLAND, CALIF. • WAREHOUSE DISTRIBUTORS IN PRINCIPAL CITIES

MANUFACTURERS and MARKETS

Consumption of Tin Cut Back 20%
New End-Use Restrictions Promised

A 20% cut in non-military tin consumption begining Feb 1 has been ordered by the National Production Authority. And further restrictions on copper, aluminum, and tin this time end-use prohibitions—are being readied for issuance soon after New Year's.

The tin cutback is an across-the-board limitation, affecting all users alike. It applies to pure tin and tin alloys containing 1.5% or more tin. Use will be cut back 20% in February and March, with no reduction specified beyond that time. During January tin users can use 100% of their average monthly tin consumption during the first half of this year.

New Pig Tin Use Restricted

Use of new pig tin in products where secondary or remelted scrap tin can be used also is prohibited. Inventories of pig are limited to 120 days' supply for tinplate makers and 60 days for other users. Scrap dealers are limited to a 60-day inventory. NPA said the total amount of tin available for both defense and civilian use during the first half of next year probably will be less than the amount consumed during the first half of 1950 but refused to give any specific figures.

As the order was announced the London price of standard tin for spot delivery again hit its record high of $1.62½ a lb reached on Nov. 8. In New York Grade A tin was offered at $1.55 a lb.

End-use Bans on Metals

The end-use bans on copper, aluminum, and tin are expected to prohibit use of these metals in certain products after Apr 1. The lists will be long and specific. Aluminum probably will be banned for ventilating ducts, for example. Brass doorknobs may be permitted only for cylinder locks and be banned for all other types of locks.

NPA told appliance wholesalers recently that the order being prepared will affect the manufacture of household appliances. Use of copper in refrigerators, washing machines, electric stoves, and other appliances may be banned, except where it is needed for the conducting of electricity. If an appliance is declared nonessential, copper may be prohibited entirely. But NPA officials said the copper order probably would not affect the number of appliances made. Rather it would force manufacturers to substitute other materials, like steel.

NPA issued its advance warning of end-use restrictions realizing that the announcement probably would cause a buying scramble, with some black-market speculation and hoarding. But the agency regards prior notice as imperative to allow users to make necessary adjustments.

Last week NPA had taken no action on a resolution by a group of appliance wholesalers demanding an immediate halt to production of color television equipment to conserve scarce materials and manpower. The agency said, however, that it had the power to stop color television production whether or not the Federal Communications Commission should agree.

New Distributor Formed for Phone, Power Firms

Telephone & Power Supply Co has been organized in Chicago as a distributor to telephone and power firms.

For electric utilities the firm, of which John A. Campbell is manager, will specialize in distribution items. It will handle poles, crossarms, pole line hardware, iron ware, drop wire, chain saws, cable spinners, and lineman, installers' and cable wiping tools. Contacts throughout the United States will be handled by the company's sales force and Neale Construction Co.

Allis-Chalmers Grants 10¢-an-Hour Wage Hike

Allis-Chalmers Manufacturing Co has announced wage increases for its 31,000 employees located in nine plants throughout the country ranging from 10¢ an hour to 8% for certain salary groups.

The increases were offered in mid-December meetings to unions representing 21,000 employees. For employees not within bargaining units, the increases were effective as of Dec. 11.

IUE Demands Rejected

Meanwhile, General Electric Co and Westinghouse Electric Corp rejected demands of the International Union of Electrical Workers-CIO for voluntary pay boosts in advance of contract wage reopenings. The companies told James B. Carey, union president, that they saw no justification for pay increases now. Employees of the two companies and Sylvania Electric Products, Inc. got 10¢-an-hour boosts other benefits last fall.

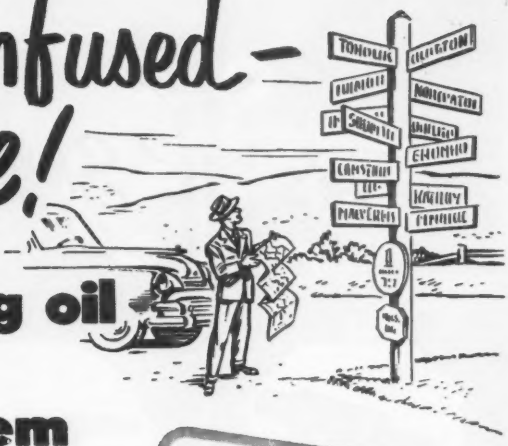
In its refusal Westinghouse pointed out that it had been scarcely two months since the company and union agreed to a contract specifying Apr 1, 1951, as the earliest date for wage reopenings. General Electric said it did not want to be "a party to pushing wages to higher levels than those at which the government will be seeking to stabilize them."

Voluntary Increase

Allis-Chalmers' wage increase was voluntary. The company has long-term contracts with most of the bargaining agents involved. Walter Geist, president, said, "There have been many changes in our national economy since our labor contracts were signed earlier this year. We felt that wage and salary adjustments were advisable now."

About $6.5 million will be added to the firm's annual payroll. Salary increases will range from a minimum of $17 a month to 8% for those with salaries of $250 a month and higher.

Don't be confused—Be Safe!



Purify insulating oil with the De Laval System

There are several ways to purify insulating oil, but none more completely safe and sure than the De Laval centrifugal method. De Laval Insulating Oil Purifiers continuously discharge the water that they throw out of the oil. It is impossible for water that has once been removed to recontaminate the oil.

Moreover, the De Laval Oil Purifiers remove water at constant high efficiency. No shutdowns are required during the course of a run for cleaning or for renewal of functional parts.

Another advantage of De Laval Insulating Oil Purifiers is that they purify the oil at low, non-carbonizing temperatures. A blotter press can be furnished to remove colloidal carbon from circuit breaker oil, if required.

Write for additional information on De Laval Insulating Oil Purifiers. Ask for Bulletin TR-1.

ADVANTAGES OF DE LAVAL INSULATING OIL PURIFIERS

Dehydrates at a single pass — no re-running

•

Constant high purifying efficiency — no shutdowns for cleaning or for renewal of parts during run

•

Safest — continuous discharge of water prevents re-contamination of the insulating oil

•

Removes water without aid of filter press; press used only to remove colloidal carbon

•

Low temperature purification; high dielectric value of oil maintained longer

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Heater cannot carbonize the oil

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Higher daily capacity of purifier saves maintenance costs

•

More economical to operate

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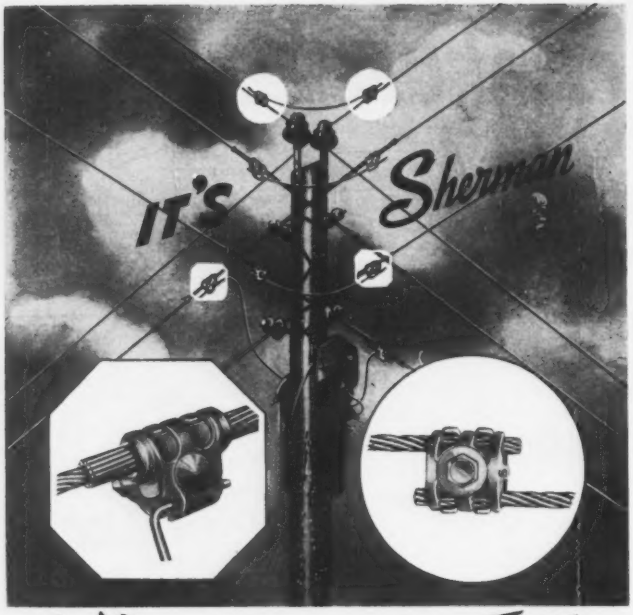
165 Broadway, New York 6 427 Randolph St., Chicago 6
DE LAVAL PACIFIC CO., 61 Beale St., San Francisco 5
THE DE LAVAL COMPANY, Limited, Peterborough, Ont.

De Laval INSULATING OIL PURIFIERS



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BATTLE CREEK, MICHIGAN

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ELECTRICAL FITTINGS

Cost-of-living adjustments will be made quarterly instead of semi-annually, as provided in the contracts. The increase which was due Jan 1 under the contracts was made effective as of Dec 11. The next cost-of-living review will be based on the Jan 15 index, and the adjustment will be effective March 1. Changes were also made in the cost-of-living formula.

SALES ASSIGNMENTS

COMPANY STAFFS

National Electric Products Corp. Pittsburgh, has named Harold L. Rush district sales manager in the Richmond, Va., territory. His headquarters will be at 100 W. Main St, Richmond. He will cover Virginia and eastern North Carolina.

S&C Electric Co. Chicago, has appointed W. J. Brockhouse and R. E. Martin sales engineers for the West Central states (Nebraska, Kansas, Oklahoma, and the western counties of Iowa and Missouri). Headquarters will be 300 Porter Bldg, 406 West 34th St, Kansas City 2, Mo.

Worthington Pump & Machinery Corp, Harrison, N. J., has made Clarence S. Wentworth manager of its Detroit office. He has been a general line salesman in Chicago.

General Electric Supply Corp has named Lewis B. Perkins Jr manager of the Philadelphia district. Perkins, who succeeds C. T. Shropshire, newly appointed vice president, was formerly manager of the supply sales division in the Detroit district.

REPRESENTATIVES

Toledo Standard Commutator Co. Owosso, Mich., has named the Musite Division of Huse-Liberty Mica Co. 171 Camden St, Boston, Mass., to handle its products in Maine.

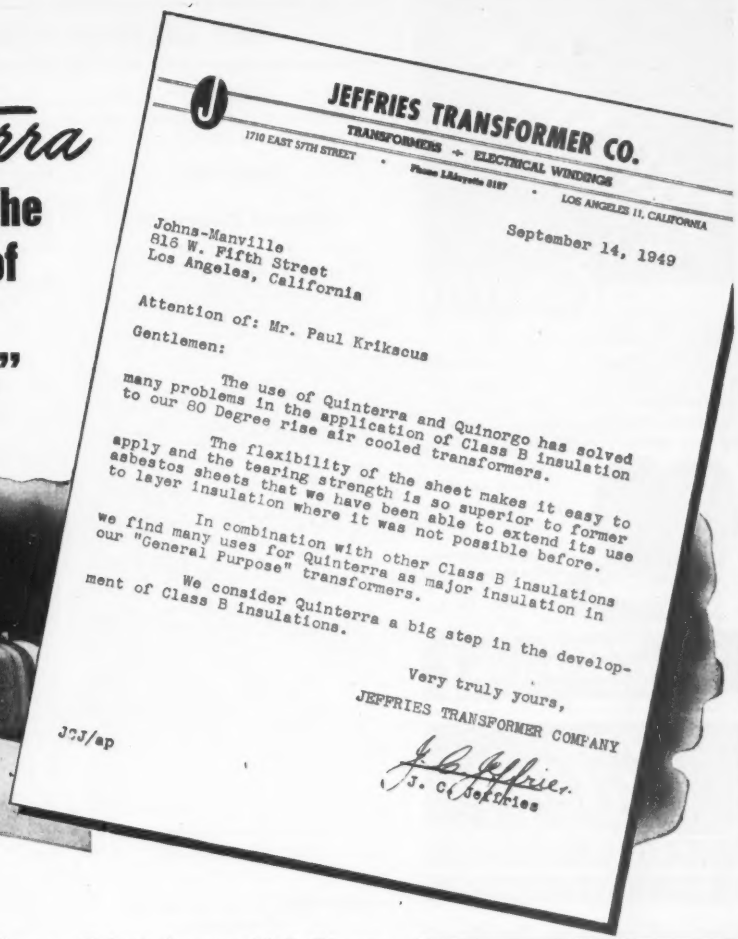
Illinois Electric Porcelain Co. Macomb, Ill., has appointed two new representatives to handle insulating porcelains on the West Coast. F. M. Nicholas, 140 Spear St., San Francisco 5, Calif., will handle northern California and western Nevada, and Kenneth Anderson Co, 412 Seaton St., Los Angeles 13, Calif., will serve southern California, Arizona, and southern Nevada.

Electric Products Co, Cleveland, has appointed Power Equipment Co, Kansas City, Mo., to handle its industrial lines in the western counties of Iowa and Missouri, the Panhandle counties of Texas, and the states of Arkansas, Oklahoma, and Kansas.

Metal Prices
Dec. 23, 1950

COPPER, Conn. V., lb.	$ .24½
LEAD, N. Y. lb.	.17
ZINC, prime Western, E. St. Louis, lb.	.17½
TIN, Straits qual, N. Y., lb.	1.50
ALUMINUM, ingot, base price	.19
NICKEL, base price	.59½
STEEL, billets, Pitts., ton	56.00
STEEL, scrap, No. 1 heavy, Pitts., ton	46.50

"We consider *Quinterra* a big step in the development of Class B insulations . . ."



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September 14, 1949

Johns-Manville
816 W. Fifth Street
Los Angeles, California

Attention of: Mr. Paul Krikscus

Gentlemen:

The use of Quinterra and Quinorgo has solved many problems in the application of Class B insulation to our 80 Degree rise air cooled transformers.

The flexibility of the sheet makes it easy to apply and the tearing strength is so superior to former asbestos sheets that we have been able to extend its use to layer insulation where it was not possible before.

In combination with other Class B insulations we find many uses for Quinterra as major insulation in our "General Purpose" transformers.

We consider Quinterra a big step in the development of Class B insulations.

Very truly yours,
JEFFRIES TRANSFORMER COMPANY

JCJ/ep

J. C. Jeffries

ONE AFTER ANOTHER, transformer companies like Jeffries are "discovering" Quinterra—the revolutionary, new Johns-Manville purified asbestos, high-temperature, electrical insulation.

. . . And, like Jeffries, they're discovering that Quinterra in a transformer gives them important selling advantages . . . as well as providing many savings in transformer design and production.

Quinterra is a paper-thin flexible, continuous sheet insulation. It is being widely used for interlayer and wrapper insulation in transformers and coils.

Its lasting dielectric strength, due to its resistance to pyrolysis, assures a greater safety factor and longer operating life. Quinterra withstands substantially higher temperatures than the hot-spot limit of 130C for Class B insulations.

QUINTERRA

- ✓ **cuts factory rejects**
- ✓ **reduces complaints**
- ✓ **improves production rate**
- ✓ **produces more uniform product**
- ✓ **cuts costs of operations**

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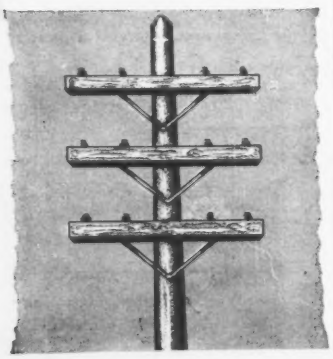


NEW ELECTRICAL CONSTRUCTION

A weekly selection of U. S. electrical construction projects announced by private and government utility systems involving more than $70,000. Also listed are major industrial and construction jobs where electrical work is indicated or implied

UTILITIES

Proposed Construction

California—State Div. Hys., P. Wks. Bldg., Sacramento, traffic signal sys., lighting and channelization Rt. 12 at East LaMesa Blvd., etc., San Diego Co. G. T. McCoy, Sacramento, state hy. engr.

Idaho, American Falls—Idaho Power Co., 1220 Idaho St., Boise, 17 mi. steel tower transmission line to Westvaco Chemical Co. plant, with radar fault locaters at the plant. **$280,000.**

Ill., Chicago—Northern Electric Co., 5234 N. Kedzie St., Zone 25, 90,000 sq. ft., brick factory top adn., asphalt roof, $90,000. Frank L. Glick, 3938 N. Central Ave., Zone 34, archt.

Mo., Kansas City—City, City Hall, Zone 6, installing high intensity lighting sys. for field at Municipal Airport, $125,000.

Montana—Bureau Reclamation, Dpt. Interior, Bldg. I-A, Denver Federal Center, Denver, Colo., furnishing, del. f.o.b. cars shipping point or f.o.b. cars Coram, 230-kilovolt switchyard and transformer circuits for Hungry Horse Power Plant, Hungry Horse Proj., Spec. No. DS-3262.

Okla., Anadarko—Western Electric Cooperative, Inc., Anadarko, electric power plant. **$800,000.** Laramore & Douglass, 79 E. Adams St., Chicago 4, Ill., consult. engrs.

R. I., Providence—Pub. Wks. Office, First Naval Dist. Headquarters, 495 Summer St., Boston, Mass., radar antenna platform at U. S. Naval and Marine Corps Reserve Training Center, Spec. 25799.

Tenn., Savannah — Tennessee Valley Electric Co-operative, c/o contractor warehouse and office, to De Witt Constr. Co., Savannah, Ga., Approx. **$100,000.**

Texas—Medina Rural Telephone Co., Medina, rural telephone pole line exten., equip. storage, Bandera Co. **$136,000.**

Tex., Brownsville—City, power transformer and switchgear, $90,000; steam generating unit, $100,000; steam driven turbo-generator, $85,000. Plans deposit $25 each. Black & Veatch, 4706 Broadway, Kansas City, 2, Mo., engrs.

Tex., Earth—Southwestern Public Service Co., Mercantile Bank Bldg., Dallas, electric power plant, $6,000,000; service shop, $90,000.

Low Bidders & Contracts Awarded

Ill., Menard — State, State Capitol, Springfield, power plant addns., alterations, underground electrical sys., to Phillips Electric Co., Belleville, **$224,148**; new boiler, stoker and accessories, to Lasker Boiler & Eng. Corp., 1852 W. 32 St., Chicago, **$108,039**, both at Menard Branch of Illinois State Penitentiary.

Ky., Paducah—U. S. Atomic Energy Comm., 1901 Constitution Ave. N.W., Wash. 25, D. C., plant to produce U-235, by gaseous diffusion process, to F. H. McGraw & Co., 51 E. 42 St., New York 17, N. Y. Total estimated cost Approx. **$500,000,000.** Ciffels & Vallet, Inc., 1000 Marquette St., Detroit 26, Mich., and Sargent & Lundy, Inc., 140 S. Dearborn St., Chicago 3, Ill., engrs.

Okla., Pauls Valley—Board of Affairs, Capitol, Oklahoma City, Zone 5, steam power plant, heating tunnels and distr. sys. at Pauls Valley Hospital, to Southern Constr. Co., 1405 W. Oklahoma St., Oklahoma City, Zone 4, **$405,331.** Est. $400,000. Bids 12/7, awarded 12/13. Benham Eng. Co., American Natl. Bldg., Oklahoma City, engr.

Pa., Bloomsburg—General State Auth., 13 and Herr Sts., Harrisburg, Dec. 13, general contract heating plant adn. at Bloomsburg State Teachers College, from S. H. Evert Co., Bloomsburg, **$80,286**, heating, from Rado Plumbing & Heating Co., Berwick, **$231,800.**

Tex., Dallas—Dallas Power & Light Co., Dallas Power & Light Bldg., 60,000 volt transformer station on Lomo Alto at Hyer St., **$575,000**; rearranging, impry. electric transmission sys. in areas of Carrollton Water Plant, **$200,000**, force account.

Wash., Seattle—City, County-City Bldg., Zone 4, plate steel penstock liners for 4 units at City Lights Ross power plant, to Consolidated Western Steel Corp., 5700 S. Eastern Ave., Los Angeles, Calif., **$1,008,653.** Bids 12/6, awarded 12/13.

INDUSTRIAL, COMMERCIAL & PUBLIC BUILDINGS

Proposed Construction

Calif., Alhambra—Butler Bros., W. Randolph and N. Canal Sts., Chicago, Ill., plans by Nelson P. Rice, 354 S. Spring St., Los Angeles, 2 story, 74,000 sq. ft. store, 343 E. Main St. **$1,000,000.**

Calif., Los Angeles—Butler Bros., W. Randolph and N. Canal Sts., Chicago, Ill., plans by Nelson P. Rice, 354 S. Spring St., 2 story, 90,000 sq. ft. store, Van Nuys and Kittridge Blvds. **$1,500,000.**

Calif., North Long Beach—Butler Bros., W. Randolph and N. Canal Sts., Chicago, Ill., plans by Nelson P. Rice, 354 S. Spring St., Los Angeles, 2 story, 90,000 sq. ft. store, Lakewood Center. **$1,000,000.**

Ill., Niles—International Register Co., 2620 W. Washington St., Chicago, plans by Engineering Systems, Inc., 221 N. LaSalle St., Chicago, Zone 1, 180,000 sq. ft. factory, Howard Ave. and Central St. **$1,000,000.**

Ind., Columbus—Bd. Comrs. Bartholomew Co. Bd. Hospital Trustees, J. R. Albright, aud., Court House, 3 units and hospital adns., alterations, 1 story, 52x115 ft., central heating plant, 4 story, 20x45 ft. and 70x45 ft., respectively brick, stone, rein.-con. ward bldgs. $1,200,000. Norman Hill, 530 Ind. Trust Bldg., Indianapolis, Zone 4, archt.

Mo., Kansas City—City, City Hall, Zone 6, municipal auditorium, and A-Bomb haven in underground garage. **$4,164,459.** John E. Maring, City Hall, city engr.

N. J., Trenton—Dpt. Navy, Yards & Docks Annex, Arlington, Va., laboratory (high pressure blower and test wing) NOY 22367, $4,600,000. Extended date, Frank Grad & Sons, 187 Market St., Newark, archts.

N. C., Lakeview—Wyandotte Worsted Co., Waterville, Me., mfg. plant, 260 acres at Lakeview, 6 mln. north of Southern Pines. **$4,000,000-$5,000,000.**

S. C., Moncks Corner—United Piece Dye Works, Nicholson St., Lodi, N. J., piece dye plant. **$1,000,000.** Francisco & Jacobus, 511 5 Ave., New York, N. Y., engrs.

Tenn., Nashville—Vanderbilt University, Nashville, plans by Marr & Holman, Stahlman Bldg., doctors bldg. in connection with Vanderbilt Hospital. **$1,000,000.**

Tex., Dallas—The Simmons Co., 900 Blk S. Lamar St., factory on 10 acre site, Harry Hines and Burbank Sts. **$1,000,000.**

Tex., Houston—T. B. Hubbard Constr. Co., 1507 Delano St., community center, Southwest Houston suburban area. **$10,000,000.**

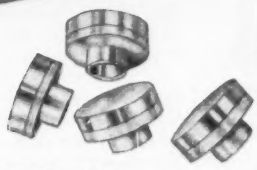
Low Bidders & Contracts Awarded

Ala., Mobile—Henderson Sugar Refinery, 749 S. Peters St., New Orleans, La., sugar refinery, to Swinerton & Walberg Co., 225 S. Rush St., San Francisco, Calif., Approx. **$2,000,000.**

Calif., Maywood—Chrysler Corp., 5800 S. Eastern Ave., Los Angeles, 1 and part 2 story, rein.-con. assembly plant addn., to Wm. P. Neil Co. Ltd., 4814 Loma Vista, Los Angeles. **$5,300,000.**

Mass., Boston — River House Trust Agents Hunneman & Co., 5 Arlington St., 222-unit apartment, 145 Pinckney St. and Embankment Rd., to Schein Cohen Constr. Co., c/o E. T. Steffian, archt., 11 Beacon St., Boston. **$2,000,000.**

Wis., Milwaukee—School Sisters of St. Francis, 1501 S. Layton Blvd., Zone 15, college, Alverno College for Women, to James McHugh Constr. Co., Inc., 6449 S. Park Ave., Chicago, Ill. Approx. **$3,000,000.**



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The Mallory "E-Treat" finish is one of the many ways in which Mallory metallurgical developments are improving performance and reducing costs of electrical contacts.

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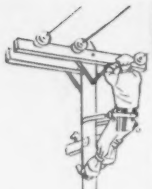

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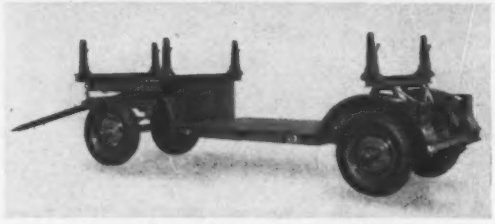

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5 tons capacity; over-all length, including tongue, 25 ft. 8 inches. Distance ground to low platform only 25-1/2 inches. Weight 5400 lbs. Equipped with electric brakes on rear wheels. Send for complete information on Model 6441—Eagle LO-BED Trailer.

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Gas Turbine

(*Continued from page 56*)

levels. For the condition indicated at Point C the flow at Veazie is about 40,000 cfs and the operating head for that flow is approximately 13 ft. The generating capacity indicated for the aforesaid limiting flow conditions is considered as prime capacity because of considerable diversity of flow conditions throughout the system and because the river flow at Veazie rarely exceeds those limits during the annual peak load period, usually occurring in December.

To meet the projected 1952 peak load of firm power customers with adverse water conditions wherein only the prime capacity of the hydro system is assumed to be available, the gas turbine plant is expected to operate on a daily load factor of not over 25%. This indicates the stand-by or peak load type of operation expected of the new plant, and because of the simplicity of its operation emphasizes its value to the Bangor system as compared to a steam unit.

It is furthermore expected that as load continues to grow, further hydro capacity will be added to the system so that in the years to come hydro and thermal capacity will keep pace in such a ratio as to afford the most economical over-all system operation.

TECHNICAL LITERATURE

Turbine-Generator Standards—*Preferred Standards for and Standard Specification Data for Generators for Large 3,600-rpm, 3-phase, 60-cycle Condensing Steam Turbine-Generators* covers ratings between 11,500 kw and 90,000 kw. There are specifications for many features of generator construction and arrangement to obtain more uniformity in design and manufacturing practices. Information from companies which aggregate more than 18,000,000 kw of steam turbine-generator capacity installed on their systems has been utilized. Publications No. 601 and 602 are available to members for 30¢ total from American Institute of Electrical Engineers, 33 W. 39th St, New York, 18, N. Y.

Temperature Measurement—*Master Test Code for Temperature Measurement of Electric Apparatus* applies to determination of operating temperature and temperature rise of all electric machines, instruments, and apparatus in common use, where temperatures do not exceed 500 C. Standards pertaining to permissible temperature and corrections of particular apparatus are not included. Types of measuring instruments, their characteristics, and use are covered. Publication No. 551 is obtainable free of charge from American Institute of Electrical Engineers, 33 W. 39th St, New York 18, N. Y.

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For Sale 112, 113

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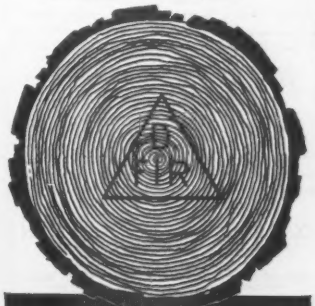
All 3 are grown on the virgin forest lands of the J. Neils Lumber Company in western Montana. All 3 are produced and treated in J. Neils modern pole plant at Libby, Montana.

J. Neils Lumber Company, since 1895 a quality manufacturer of forest products, invites your inquiry on transmission and telephone poles. An illustrated folder on J. Neils treated poles, and information regarding their application to your own requirements, will be furnished on request.



POLE DIVISION
J. Neils Lumber Company
Libby, Montana

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all the U. S. Saving Bonds you can and

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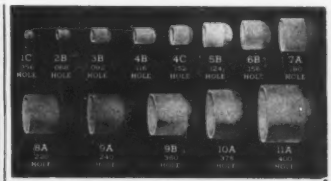

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Electrical Power, lighting layouts and electrical controls.

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Please submit complete resume stating experience, education, salary required and availability date.

THE H. K. FERGUSON COMPANY

Engineers and Builders

The Ferguson Building, 1783 East 11th Street Cleveland 14, Ohio

REPLIES (Box No.): Address to office nearest you
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WANTED: MANAGER for major power generation and transmission system in Northwest Arkansas. Required, successful record of executive accomplishment. Experience desirable in engineering, utility or cooperative fields but principal requirement is demonstrated capacity to apply management skills. Application should reach Arkansas Electric Cooperative Corporation, Ozark, Arkansas, before January 18, 1951.

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(Continued on following page)

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How to interpret control diagrams
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Principles and application of most types of electrical control devices. Most of material cannot be found in any books. Designed for easy reading and understanding. Complete refund if not immediately satisfied that course is worth many times remarkably low introductory price.

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ELECTRICAL ENGINEERS: Must have eight to twelve years' broad and thorough experience in electrical design and operating problems of industrial plants with thorough knowledge of selection, installation, economical operation and maintenance of electrical equipment. Must be graduate.

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—

Give experience, education, age, references, personal history, salary received and salary expected. Please be complete and specific.

ALL INQUIRIES WILL BE CONSIDERED PROMPTLY AND KEPT CONFIDENTIAL

E. I. du Pont de Nemours & Co. (Inc.)

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Wilmington 98, Delaware

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1 GENERAL ELECTRIC SYNCHRONOUS FREQUENCY CHANGER

MOTOR GENERATOR SET

2 Unit 3 Bearing, consisting of:

1 ATB-Frame 9855	1 Type 984S
12 Pole—600 KVA	6 Pole — 800 HP
.65 PF.—390 KW	.8 PF.—1200 RPM
1200 RPM — 450 Volt	550 Volt
3 Phase 120 Cycle AC Generator	3 Phase 60 Cycle Synchronous Motor

complete with

2 Exciter Field Rheostats Line Reactor for Reduced Voltage Starting, Switchgear and Instruments.

- Installed New 1948
- Set up as operated
- Used Less Than One Year
- Excellent Condition
- Can be converted to 140 cycles

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Galvanized 6 Strand Wire Rope. Cotton Center, Rt. Lay, Preformed. Breaking Strength Over 6600 Lbs.

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Spools—7100' & 8000'

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GENERATING

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INCLUDING STEEL BUILDING 110' x 125'

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5 units—980 KVA total—Complete. 180 FBM Twin Engines. Gas—Convertible to Oil. Condition A1. Operating to November 7. Immediate Delivery. Located 100 miles South San Antonio, Texas.

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OIL PRODUCER
FIRST NATIONAL BANK BUILDING
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EXECUTIVE ENGINEER Thoroughly familiar with public utility operations and planning. Desires connection with progressive organization as general manager, chief engineer, or equivalent position. Graduate, registered professional engineer and A.I.E.E. member. Post graduate studies in management, finance and engineering. 25 years experience in construction, engineering and management of electric utilities. Good personality, excellent health, married, age 46, and employed. Prefer Southwest or South but will consider other locations. PW-8415, Electrical World.

MANAGER, BROAD experience all phases electric, gas, water, other utilities. Steam, hydro, oil. Top references, available Jan., exempt. PW-8588, Electrical World.

U. S. Government

UNITED STATES DEPARTMENT OF THE INTERIOR, Bureau of Reclamation. Sealed bids (Specifications No. DS-3257) will be received by Bureau of Reclamation, Denver, Colorado, January 16, 1951, and then publicly opened for furnishing two 36,000-kva, 13,600- to 132,800/230,000 Y-volt, single-phase, forced-oil-cooled power transformers for Grand Coulee Power Plant, Columbia Basin Project, Washington. Delivery is desired within 780 days. For particulars, address Bureau of Reclamation, Building 1-A, Denver Federal Center, Denver, Colorado.

MICHAEL W. STRAUS, Commissioner.
(100)

UNITED STATES DEPARTMENT OF THE INTERIOR, Bureau of Reclamation. Sealed bids (Specifications No. DS-3265) will be received by Bureau of Reclamation, Denver, Colorado, January 23, 1951, and then publicly opened for furnishing governors for hydraulic turbines for Pole Hill Power Plant and Flatiron Power Plant for Colorado-Big Thompson Project, Colorado. Delivery is desired within 480 days. For particulars address Bureau of Reclamation Building 1-A, Denver Federal Center, Denver, Colorado.

MICHAEL W. STRAUS, Commissioner.
(101)

---

75 H.P. MOTOR

3 Ph., 60 cycle, 220 V., 1750 r.p.m. Style 513 449., Frame 6530. Westinghouse Type D Wound Rotor Open Induction Motor. Suitable for crane or hoist. Less than 200 Hours use in light duty service. Available immediate inspection and delivery. Complete with drum controller and grids.

PULVERIZING MACHINERY COMPANY
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3—75 Kva 13200-2400/4160Y Transformers, GE, Type HS, Cat. 27H258; 4—2½% Taps Below, Serial 7,514,-653-54-55. In service two years.

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Lexington, Tennessee

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Guaranteed Rebuilt
MOTORS-GENERATORS-CONTROLS
NOW IN STOCK
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Anything you want

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TRANSFORMERS

QU.	KVA.	MFR.	VOLTAGE
1	7000	G.E.	138000—4100, 3 ph.
3	3333	West.	132000—7620/13200Y
1	2000	G.E.	69300—13800/23900Y, 3ph.
3	1000	West.	66000—7200
3	100	West.	44000—7200/12470Y
3	8333	West.	43800—13900
4	6667	G.E.	38100/66000Y—12700/22000Y
2	15000	A.C.	33000—12500, 3 ph.
2	7500	A.C.	33000—13200, 3 ph.
1	5000	G.E.	33000—2300/4600, 3 ph.
6	200	G.E.	33000—2300/6900
6	75	Mol.	33000/16500—2300/6900
4	450	A.C.	25410/44000—13280/23000
3	750	West.	13200—440
3	333	West.	13200—440
3	200	Mol.	11000—2300
1	1500	West.	4000—2300, 3 ph. Auto
3	250	A.C.	2300—460

Also the following small transformers of representative makes

140 5 KVA 2400—120/240 Conventional type
50 5 KVA 2400—120/240 Protected type
75 7½ KVA 2400—120/240 Conventional type
50 10 KVA 2400—120/240 Protected type
40 10 KVA 2400—120/240 Conventional type
60 15 KVA 2400—120/240 Conventional type

INDUCTION REGULATORS

1—150 KVA. G.E. 200 A. 4000 V. 3 ph.
3— 46 KVA West. 200/400 A. 2300 V.
6— 36 KVA G.E. 150 A. 2400 V.
3— 36 KVA G. E. 75/150 A. 4600 V.

CIRCUIT BREAKERS

1— 600 A. 37 KV G.E. FHKO—139–450 MVA*
1— 400 A. 37 KV G.E. FHKO—236–500 MVA*
2—1200 A. 34.5 KV G.E. FKO—339–1000 MVA*
4— 600 A. 15 KV G.E. FHKO—139–750 MVA*
2— 600 A. 15 KV West. B-28—B-500 MVA**

* Outdoor ** Indoor

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Buckeye—600 r.p.m.—medium speed Westinghouse generator—440/3/60—complete with modern dead front switch gear. Units equal to new—used only 50 hours.

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A.C.—50 AND 60 CYCLES
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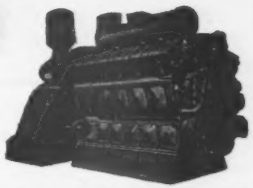

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KVA	Make	Model	HP	RPM	KVA	Make	Model	HP	RPM
1875	Fairbanks Morse	38F16	2600	300	375	Enterprise	D6G-6	450	480
1430	Fairbanks Morse	38D8⅛	1600	720	330	Superior	KNA	396	514
1250	General Motors	16-278A	1600	720	312	General Motors	8-268A	450	1200
937.5	General Motors	12-567	1080	720	312	Clark	MD-4	375	327
625	Alco	6-13½x13T	750	600	187	Ingersoll Rand	S	225	514
435	Baldwin	VO-6	510	480	125	General Motors	3-268A	180	1200
400	Buckeye	50	480	600	75	General Motors	6046C	90	1200

D.C. UNITS ALSO AVAILABLE

A. G. SCHOONMAKER COMPANY, INC.

ENGINEERS DIVISION, 50 CHURCH ST., NEW YORK 7, N. Y.

FROM AVAILABLE STOCK

TURBO GENERATORS

Qu	KW	Make	Desc.
2	750	G.E.	Condensing — 425 lbs. 750 T.T. I.S.P. 440V. 3 ph. 60 cy— Built 1944
1	625	Westg.	Non-cond. 125 lbs. I.S.P. 5/20 lbs. B. P.-440 v. 3 ph. 60 cyc.
1	400	Westg.	Non-condensing—125/150 lbs. I.S.P. 5/10 lbs. B.P.—240/480 v. 3 ph. 60 cy.
1	300	G.E.	Non-condensing 150/175 I.S.P. 5/10 B.P.—480 v. 3 ph. 60 cy.

SYNCHRONOUS CONDENSERS

	KVA	Make	Type	Volts	Speed
1	5140	Whse.		2400/4160	600
1	4000	G.E.	TSC	2400/4160	900
1	3000	Whse.		2400/4800	720

MOTOR GENERATOR SETS

3 ph. 60 cy.

Qu	KW	Make	Speed	DC Volts	AC Volts
1	2000	G.E.	300	266 250 67	11000
1	1800	G.E.	600	125/250	2300/4160
1	1500	G.E.	360	275	2200/4400
1	1000	Whse.	514	250	2300
1	1000	Whse.	900	600	4150
1	750	Whse.	900	275	2300/4150
1	600	Whse.	900	250	2300/6900
1	500	Whse.	900	250	440
1	400	G.E.	720	240	440/2300

TRANSFORMERS—60 Cycle

	K	Make	Type	Ph	Voltages
3	2666	Whse.	OISC	1	66000x11000
1	2500	Al. Ch.	OISC	3	12300x2300
3	1250	G.E.	HVDDJ	1	6600x300
1	1000	GE	HT	3	13200x2300/4600
3	667	Whse	OISC	1	66000/34500x2300
1	600	GE	HT	3	13200x2300/4600
1	600	Al. Ch.	OISC	3	2300/4150x220/440
3	333	Phila.	OISC	1	26400x2600

BELYEA COMPANY, INC.

OFFICE & SHOP
51 Howell St., Jersey City 6, N. J.

TRANSFORMERS

BOUGHT AND SOLD

We carry a large stock of transformers, and invite your inquiries.

PIONEER TRANSFORMER REBUILDERS

We rewind, repair and redesign all makes and sizes. *One Year Guarantee.*

THE ELECTRIC SERVICE CO., INC.

"AMERICA'S USED TRANSFORMER CLEARING HOUSE"

SINCE 1912 CINCINNATI 27, OHIO

J. L. HEMPHILL & CO.

ELECTRICAL ENGINEERS & EQUIPMENT

TRANSFORMERS

1—1500 KVA G.E., 3 Ph., 4150V, 2300V Pyranol
1—1000 KVA G.E., 3 Ph., 4150V, 2400V
1—1000 KVA G.E., 3 Ph., 4150V, 2 Ph., 2400V
3— 667 KVA G.E., 1 Ph., 33,000V, 2300V Sec.
3— 500 KVA, Packard, 1 Ph., 2400V, 480V Sec.
1— 500 KVA Kuhlman, 1 Ph., 4150V, 2300V
3— 400 KVA G.E., 1 Ph., 6900V, 2300V Sec.
3— 250 KVA Maloney, 1 Ph., 13,800V, 240/480 Sec
1— 75 KVA G.E., 3 Ph., 2400V, 240/480V Sec.
6— 50 KVA, G.E., 1 Ph., 13,450V, 120/240V Sec.

MOTOR GENERATOR SETS

2—1500 KW G.E., 600V, 600 RPM, 4000V Syn.
2—1250 KW G.E., 275V, 600 RPM, 4000V Syn.
1—1000 KW G.E., 600V, 514 RPM, 4000V Syn.
2— 150 KW G.E., 125/250V, 1200 RPM, 4000V Syn.
2— 75 KW G.E., 250V, 1200 RPM, 220V Syn.

SLIP RING MOTORS

1—2500 HP G.E., NT, 257 RPM, 6600V
1— 500 HP G.E., NT, 600 RPM, 440V

SYNCHRONOUS CONDENSER

1—2500 KVA Whse., 720 RPM, 2200V with D.C. Exc.

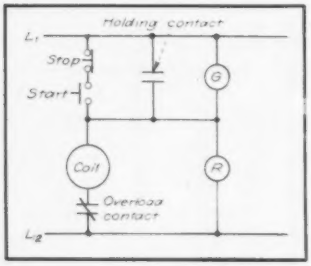
Large Stock of A.C. and D.C. Equipment

LETTERS TO THE EDITOR

Indicating Light Circuit

To the Editor:

The red-green indicating light circuit on a magnetic switch to avoid the use of auxiliary interlocks described in Electrical World, August 14, 1950, page 110, and September 11, 1950, page 206, is hardly one which can be used indiscriminately without careful consideration of all the factors involved.



True, it will be satisfactory in most cases, but it must be remembered that the smaller the switch and the larger the lamps, the more likely it is that trouble will be encountered. On 25 cycles especially, where the coil resistance is high, the lamp connected across the pushbutton contacts (green for instance) could receive a voltage as much as 25% below normal which would provide inadequate illumination. Also on 25 cycles the coil magnetizing current for the smaller switches could actually be less than the current taken by the lamp so that the switch would not drop out when the stop button is pressed. The lamp could be connected through the stop button and the switch would then open, but when the button is released the coil will be re-energized through the lamp with a current, which while it will not likely reclose it, could possibly over-heat it.

Another admittedly remote possibility of trouble, which however has actually happened on more than one occasion, is breakage of the filament of the green lamp falling across its leads, and thereby providing a relatively low resistance short circuit across the lamp which can cause false operation of the magnetic switch.

The circuit is therefore of the "try it and see" variety, and has merit when lamps are to be added to an installed job, where its operation can be easily tried out, but where it is not easy to obtain interlocks. It is hardly one that can be used as a manufacturing proposition.

W. T. Fanjoy, Engineer
Industrial Control Eng'g Div
Canadian General Electric Co
Peterborough, Ontario, Canada

Five of You . . .

To the Editor:

We know you will be interested in the special way an article in the October 2nd issue of Electrical World was put to use in our special training program among employees of our Eastern Oregon Division.

The "In the Industry" column on page 20 of this issue of Electrical World, suggests management cannot expect to receive the help of all employees in resisting the aggression of public power if no steps are taken to properly inform them. A letter from Mr. Ward, president of our company, includes this article to prove that our employee educational program on this question requires their sustained effort to be sure that full information is made available to all employees. His letter also mentions our new employee booklet, "Five of You and Public Power," which is the initial text book on this subject.

Since the distribution of this booklet, we have already found that it inspires employees to do something about influencing their friends and neighbors on the public power question. We find they no longer hesitate to get into a discussion with people, for they now have the proof that enables them to convince even the most skeptical. Their efforts, as you know, are invaluable in maintaining favorable public and customer opinion in areas where certain groups are actively promoting public power. Our employee educational program, and the Grass Roots Impact Plan of Reddy Kilowatt Service were introduced to the employees on this division simultaneously, and thereby impressed them still more, because of the nation-wide attention being given the subject.

E. A. Nickelsen
Commercial Manager
California-Pacific Utilities Co
405 Montgomery St
San Francisco, Cal.

(Editor's Note: Electrical World is proud to have had some small part in this program.)

Stop Valve Omission

To the Editor of Electrical World:

I note on page 11 of the November 13th issue of "Electrical World" a paragraph as follows:

"Progress was reported in acceptance of the proposal to eliminate the stop valve and rely on the turbine throttle value in the case of single-boiler single-turbine installations. Hope was expressed that the omission would soon be sanctioned by the ASME boiler code. Somewhat similar comment was made about the superfluity of explosion doors under the combustion practice now prevailing."

I believe there is some misunderstanding regarding the statement of the members of the Prime Movers Committee. It is my opinion that the statement was made expressing hope that the omission of the boiler stop valve in the case of single-boiler turbine installations would soon be sanctioned by the Pennsylvania State Boiler Code. I do not believe that this statement was made regarding the ASME Code as our committee was of the opinion that such an installation was satisfactory to the requirements of the ASME Boiler Code since the publication in the October 1949 issue of "Mechanical Engineering" of Case No. 1102, which is an interpretation of paragraph P-301 of ASME Boiler Code. The difficulty that the members of the association have been having in securing approval of installations without the separate boiler stop valve lies with the interpretation of the Pennsylvania State Boiler Laws.

E. Gordon
Chairman
Prime Movers Committee, P. E. A.
The Potomac Edison Co
Hagerstown, Md.

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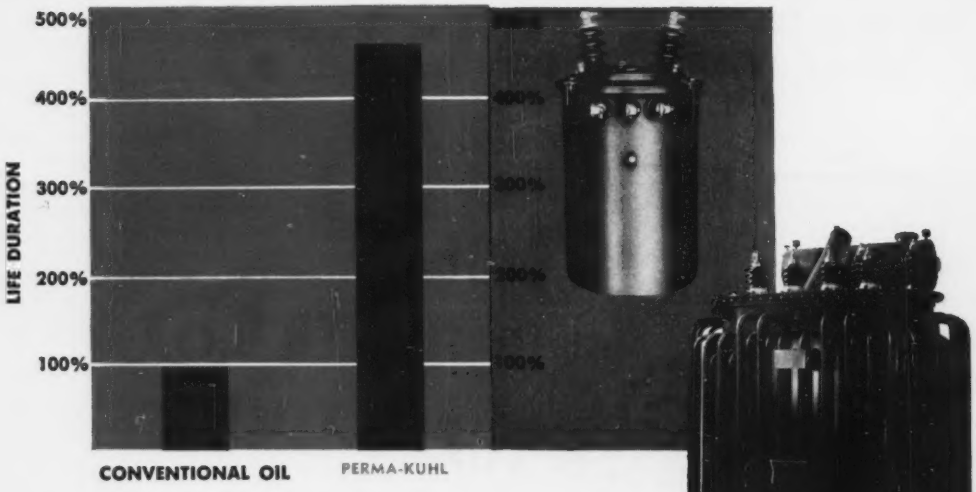

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